AMERICAN MACHINIST

May 14, 1941

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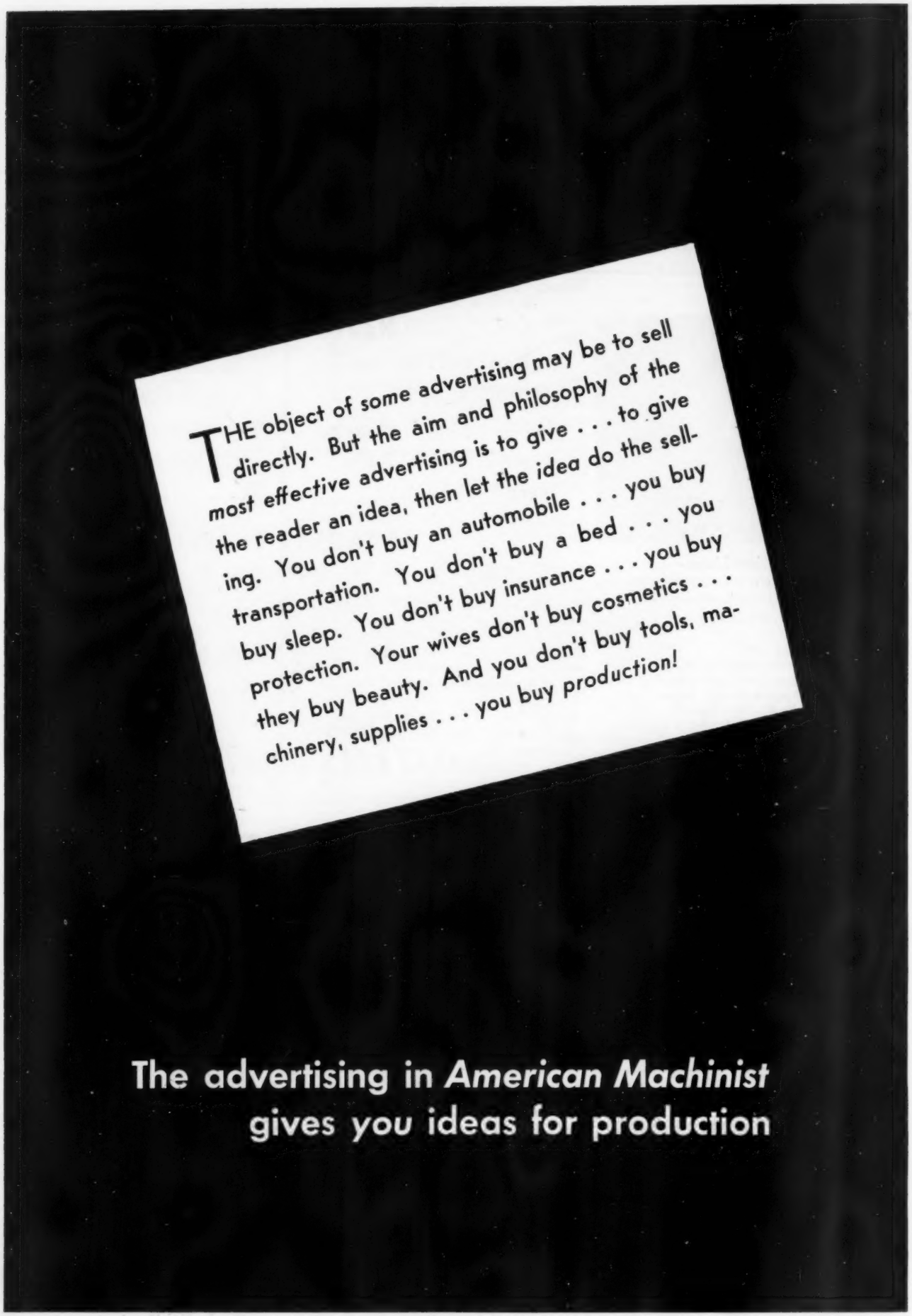
THE object of some advertising may be to sell directly. But the aim and philosophy of the most effective advertising is to give . . . to give the reader an idea, then let the idea do the selling. You don't buy an automobile . . . you buy transportation. You don't buy a bed . . . you buy sleep. You don't buy insurance . . . you buy protection. Your wives don't buy cosmetics . . . they buy beauty. And you don't buy tools, machinery, supplies . . . you buy production!
The advertising in American Machinist gives you ideas for production

WHAT'S IN THIS ISSUE

FLUSH

Plane people are always up in the air over one thing or another. A while ago it was flush riveting, more recently it was the air- vs. liquid-cooled engine. One reason for the flush riveting fight subsiding was that plane makers vigorously attacked the problem and emerged victorious. At Bell Aircraft, for instance, a technique has been developed which includes actual manufacture of the rivets themselves. Tolerances are what everyone "knew" was impractical a couple of years ago. You'll find plenty of interesting information in the article on page 443, by Arthur Schwartz, a Bell tool engineer. It's one of two articles comprising the Armament Section.

ARTHUR SCHWARTZ
. . . facts on flush riveting

PREVIEW

Anyone ever faced with the problem of enlarging facilities while maintaining output should be sympathetic when the aircraft industry is mentioned. Never before in industrial history has any industry been called upon to accomplish what is now demanded of plane and engine makers. The only thing remotely comparable to it is the annual retooling of automobile makers —but then they're not faced with expansion figures like 100, 200 and 300 percent. And they do it the easy way: Stop production completely, rearrange their equipment, then get going again in gradual stages. All this is by way of a tribute to the aircraft people, who are today turning out more planes and engines than ever before, while millwrights, electricians and tool engineers swarm over eternally altered production lines. The key to success, of course, lies in having a plan—an accurate blueprint of the production process for every combination of old and new equipment. At Wright Aeronautical they solved this problem with a considerable improvement on an old idea. On page 419 H. E. Linsley tells about it.

H. E. LINSLEY
. . . proves that planning pays

TIP

As materials for tool tips, carbides are unequalled for many types of work. The various standard tool shapes recently introduced have helped considerably in cutting cost, but on many jobs special rake and clearance angles are needed, necessitating special tool shapes. But a trick worked out at Ford, which could be applied by anybody having a moderately large run, permits using standard carbide tool shapes even when special angles are required. In addition, it simplifies considerably the grinding technique needed in the toolroom. For the details, see Special Set-Ups With Standard Tools, on page 424. It's by Fred W. Lucht, an engineer associated with Carboloy.

FRED W. LUCHT
. . . economy with carbides

BASIC

Every so often we like to return to' fundamentals. In these hectic days, as in most others, it's easy to lose sight of basic principles in the enthusiasm for a new wrinkle or ingenious detail. Hence the article on page 421. Compiled by E. W. P. Smith, Lincoln Electric consulting engineer, it analyzes the principal types of electrodes used for arc welding, explains their various characteristics, and discusses the applications for which each is suitable. Drawings and photographs help make clear some of the finer points.

E. W. P. SMITH
. . . down to fundamentals

COMING

With the problem of precision assuming an ever increasing importance to the machine tool industry, we feel it only fitting to present some new findings in the field of testing machines for accuracy. So in the next issue we begin a two-part article by Dr. George Schlesinger analyzing the time-honored method of using test mandrels to check up on machine tools. Dr. Schlesinger discusses several fundamentals and fine points which assume considerable importance when you're trying to measure down to the last tenth. It will begin in the May 28 AMERICAN MACHINIST.

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ESTABLISHED 1877. AMERICAN MACHINIST BURNHAM FINNEY, Editor

Production line layout strips are prepared away from the main board by a layout engineer familiar with the operations involved. He uses die-cut templets of different colors to show machines

A Preview of Plant Layout

BY H. E. LINSLEY, WRIGHT AERONAUTICAL CORPORATION

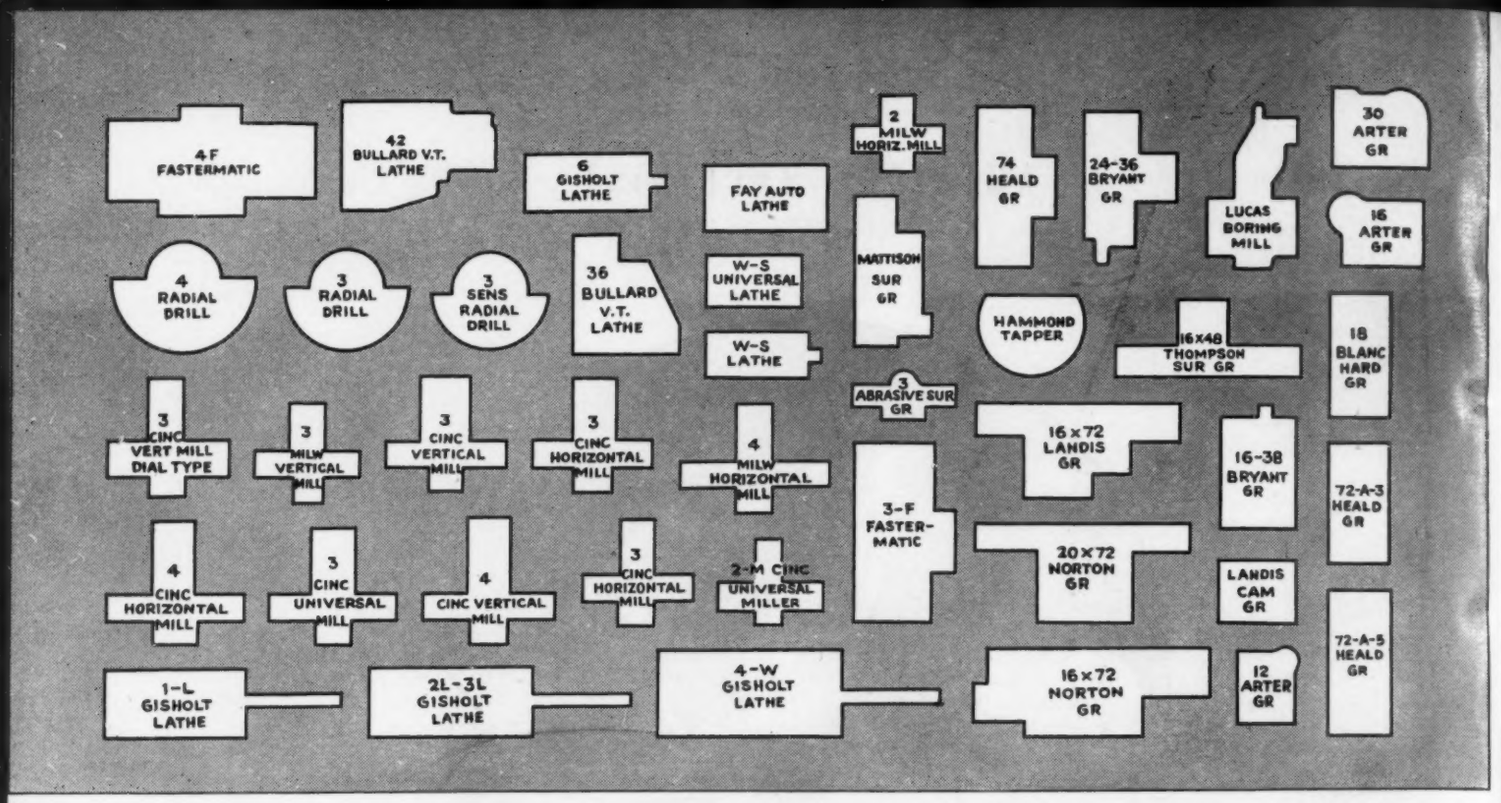
Each major floor plan consists of a large board on which are arranged separate strip showing groups of machines in position

CONSTANTLY INCREASING production schedules at the Wright Aeronautical Corporation, coupled with the impossibility of procuring several hundred new machine tools within the period of a few months, made it necessary to devise some method whereby change-overs in plant layout could be made with a minimum expenditure of time and labor.

The floor plan of the plant was first laid out on large sheets of white Upson board. The width and location of the main and cross aisles was determined with adequate space being left for operator movement and storage of parts in process. Strips of black painted Upson board were then prepared, each strip representing a section of floor area between the aisles. On these strips the lines of machines were laid out in double rows, back to back, by means of cardboard templets securely held in place with map tacks. In this way it is possible to move any machine line bodily from place to place on the layout without disturbing the arrangement of individual machines.

Production line strips were thus prepared to obtain the best possible output using existing machines, while others were prepared to provide for increased production with new equipment that would be available in the near future. Still other strips were made ready for maximum production with automatic and multi-spindle equipment. When the new machines became available, all that was necessary to revise the layout was to lift up the old strip and replace it with the new. Similarly, when it became necessary to expand one department to the extent that another was forced into a different building, the change could be made in a short time without unpinning the hundreds of templets involved.

In making the layout for the main factory building of the new plant now under construction at Lockland, Ohio, which has a floor area of 1,467,320 sq. ft. all under one roof, and in which some 1,600 new machine tools are involved, this system proved itself especially useful by doing away with the



Master templets were prepared to show commonly used machines at a scale of $\frac{1}{8}$ in. to the foot. Names of these machines then were printed on sheets of cardboard so that a dinking die for cutting out the individual templets would show the name within its profile

confusion which inevitably exists when a considerable number of men try to work on the same project on one big board, even though the board itself measures some 15 ft. square.

How Many Machines?

The first step in preparing this project was, of course, to determine the total number of machines required. This was done by multiplying the monthly production schedule by the standard time per part and dividing the product by the number of working minutes per month. The result gave the machine load and established the number of machines required for each operation. Charts were then prepared showing the machines needed for each machining sequence and the floor space required for each. An allowance was made of 3 ft. between machines end to end, and 30 in. back to back; to this was added the working space needed by the operator and the necessary provision for material storage, the clear aisle space was added, and the total floor space required for the department was thus obtained. On this basis it was possible to compute the total area of the new building.

The charts were then passed to the layout men for preparation of the layout strips. In order to provide for normal expansion, one machine space was left open in every ten machines, the space being located next to the most heavily loaded machine as the one most likely to require duplication, with the provision, however, that the space left open was capable of accommodating the largest machine in the department. Furthermore, when any machine was found to be loaded to within 85 to 90 per cent of capacity, space was left alongside this machine for duplication. Ample space is thus provided for a substantial expansion without disturbing the other machines.

Each major line, such as crankcases, crankshafts and gears, was constructed separately by a layout man familiar with the detail operations of the particular parts involved. Working quietly at his own table, and consulting with the supervisor of the particular department involved, he was able to lay out the line to the best possible advantage. These separate divisions were then brought together on the main floor plan and coordinated under the supervision of the chief of the layout department.

"Mass Production" of Templets

Departments which did not lend themselves readily to line layout, such as the heat-treating and the plating departments, were set up as a unit on a board representing the floor space allocated to them, and then arranged on the main floor layout.

With the tremendous number of machines involved, the task of cutting out individual templets for each machine seemed likely to be of such proportions as to seriously delay operations. To avoid this a master templet was prepared on which the most commonly used machines were laid out in plan view to the scale of $\frac{1}{8}$ in. to the foot, the same scale as used for the floor plan. The names of the machines were then printed in the proper positions on sheets of cardboard and the profiles stamped out with a dinking die. A light light pressure of the fingers suffices to remove any wanted templet from the sheet. Uniformity thus was assured and a great saving of time effected, time which normally be spent in the tedious task of drawing the templets to scale and clipping them out with shears.

Into the Blue

Templets of different colors are used to indicate the equipment required for different production schedules. Thus, yellow templete indicates the machines needed for current production, red indicates those required for the production demanded in three months' time, while blue shows the additional machines planned to provide the production scheduled at some future date.

To men engaged in the automobile industry such layouts probably present few major difficulties, but never before in the aircraft engine industry has such a system of line production been attempted, and it reflects credit to all concerned that such an undertaking was carried out successfully, not merely without delaying production, but in the face of schedules which increased steadily from month to month.

Which Electrode?

BY E. W. P. SMITH, CONSULTING ENGINEER, LINCOLN ELECTRIC COMPANY

Efficient, economical welding is achieved only when proper electrodes are used. Here are chief characteristics of basic types

TO MAKE an intelligent electrode selection, it is necessary to know the physical properties required, the type of joint, the position in which the weld is to be made, and the condition of work fit-up, etc. All these factors have a considerable bearing on final weld quality, and all must be considered in selecting an electrode. Fortunately, enough types of electrodes are made to permit welds with nearly any combination of factors.

Electrodes may be classified in various ways. For example, by: (1) mechanical characteristics such as tensile strength, ductility, etc.; (2) method of use, such as position in which they are to be used, i.e., flat, vertical, overhead, horizontal, etc.; (3) type of joint, such as fillet, deep groove, etc.; and (4) shape of the bead, such as flat, convex, or concave. Shape of the bead is a common method of classification, since the service or operating requirements determine the shape of the joint of which the bead is a part. For convenience in this discussion, we will designate these bead classes as follows: flat bead, Type A; convex bead, Type B; and concave bead, Type C.

Weld metal deposited has certain common characteristics. Endurance limit is high, running in the neighborhood of half the tensile strength. Specific gravity runs generally from 7.84 to 7.86. Impact strength is also high, averaging 30 to 80 ft.-lb. Izod.

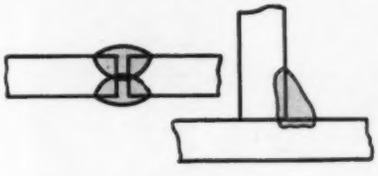


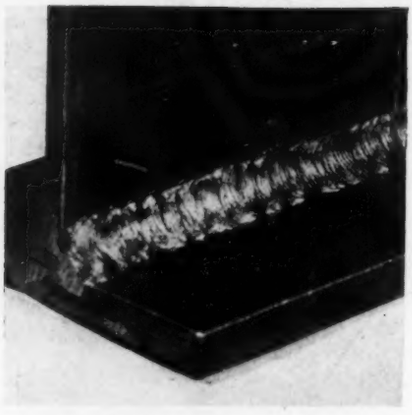
Fig. 1—Type A electrodes produce comparatively flat beads. Above at left is a downhand weld in square groove butt joint in $\frac{1}{4}$-in. plate; center is a three-position weld in 6-in. pipe with a V-groove joint; while at right is a three-pass vertical fillet weld in $\frac{3}{8}$-in. plate

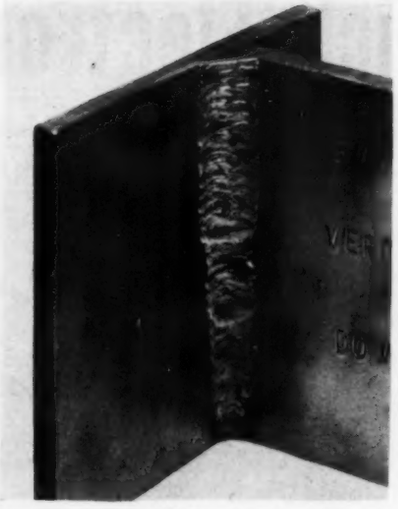
Type A, Flat Bead—This type may be classified as a general-purpose electrode. It is used for a wide variety of work and possesses high average mechanical characteristics. Heavily coated, it is best suited for direct current with electrode positive.

Available in diameters of $\frac{5}{32}$ in. and smaller, it is suitable for use in all positions. A special $\frac{3}{16}$ in. size is also made for all-position welding. It is suitable for fillets, deep grooves, and all types of joints in all positions. It has deep penetration qualities and is used very satisfactorily on square-groove butt joints where the electrodes actually scarf or melt the plates. It produces a rather flat bead of the general type shown in the photographs and sketches above, Fig. 1.

Of the same general characteristics are several electrodes for welding the low-alloy, high-tensile steels. In this same group is an electrode in a higher range, giving 90,000 to 105,000 lb. per sq.in. ultimate tensile strength and elongation of 12 to 22 percent in two inches. Characteristics of these and other types are tabulated in the accompanying table, as designated by the American Welding Society in its Filler Metal Specifications.

(*Continued on next page*)





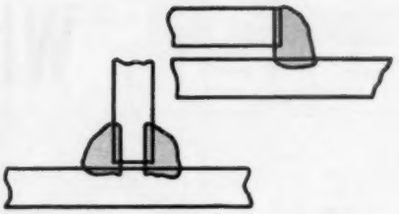


Fig. 2—Type B electrodes produce beads with a pronounced convex shape. At upper left is a lap weld in $\frac{3}{16}$-in. plate; below it is a fillet weld in $\frac{3}{16}$-in. plate with a $\frac{1}{16}$-in. gap; at right is a four-pass corner weld in $\frac{1}{8}$-in. plate

Type B, Convex Bead—This class of electrode also has a heavy coating and is used with direct current with the electrode negative. It may also be used with alternating current. Sizes of $\frac{5}{32}$ in. and smaller are suitable for all positions, and in larger sizes for welding in flat positions. It may be used for fillet welding, single or multiple pass, and can be used for butt welds of the V-groove or U-groove type. Due to its deposition characteristics and ability to build up, it is used to fill gaps in cases of poor fit-up. Penetration is somewhat less than with the Type A (flat bead) electrode, and spatter is somewhat less. It possesses somewhat higher ultimate tensile strength and slightly less ductility. Because it does not penetrate deeply, it is used in cases where an in-wash of a base metal is not desirable or required. It produces a somewhat convex bead as indicated in Fig. 2.

CHARACTERISTICS OF ARC WELDING ELECTRODES

Type	A. W. S. Classification No.	For Positions *	General Description	Treatment of Welded Specimen #	All Weld Tension: Lb. per sq. in.	All Weld Tension: Elong. in 2 in.
A.....	E6010	F, V, OH, H	Heavy covering, useful with d.c. Electrode positive only	SR NSR	60,000 65,000	27 22
A.....	E7010	V, F, OH, H	Heavy covering, useful with d.c. Electrode positive only	SR NSR	70,000 75,000	22 17
B.....	E6012	F, V, OH, H	Heavy covering. Usually used with electrode negative d.c., or on a.c.	SR NSR	60,000 65,000	22 17
C.....	E6020	H-fillets, F	Heavy covering. Usually used with electrode negative or a.c. for fillets and electrode positive or a.c for flat welding	SR NSR	60,000 65,000	30 25
C.....	E6030	F	Heavy covering. Usually used with electrode positive on d.c., or with a.c.	SR NSR	60,000 65,000	30 25
C.....	E7030	F	Heavy covering. Usually used with electrode positive d.c., or with a.c.	SR NSR	70,000 75,000	25 20
.....	E6013	F, V, OH, H	Heavy covering. Usually used on a.c.	SR NSR	60,000 65,000	22 17

* F—flat; V—vertical; OH—overhead; H—horizontal.

\# SR—stress relieved; NSR—not stress relieved.

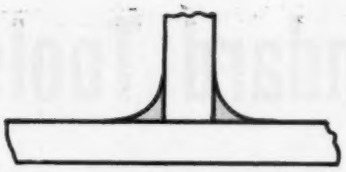


Fig. 3—A Type C electrode results in definitely concave bead contours. One produced this fillet weld in ½-in. plate in a tilted position

Type C, Concave Bead—This type of electrode has a heavy coating and can be used with direct current with either positive or negative polarity. It can also be used with alternating current. It is used in the flat position only and is not suitable for vertical or overhead work, although under special conditions as to set-up, such as 30 deg. from vertical, it may be used for fillets, welding downward. This type is used for fillets or butt joints of the V-groove or U-groove types. It flows very readily with a heavy slag covering the weld. It is sometimes known as the "hot rod" type. It produces a very smooth bead, slightly concave, and in some cases very concave, as in Fig. 3.

In this general group are several different types, one usually used for fillets in the flat or horizontal position, another for U-groove work. This type is also made for high-tensile low-alloy steels. In this same group is another electrode known as a finish-pass or last-pass electrode, which is used to provide an exceptionally smooth final bead on a multiple-pass U-groove joint, as in Fig. 4.

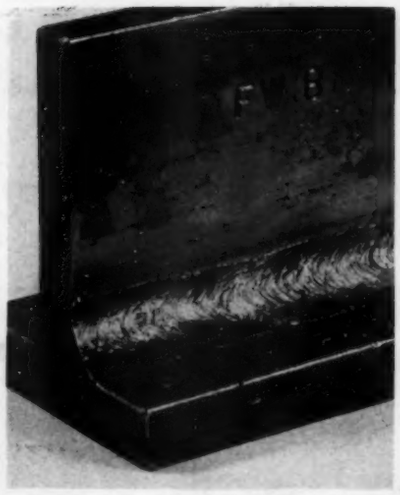
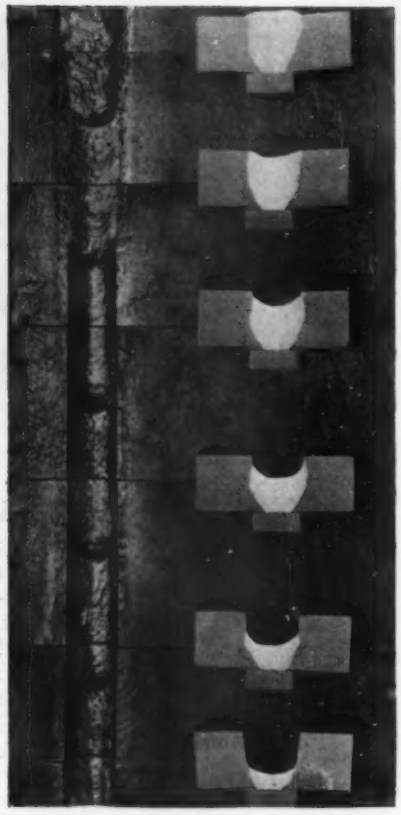
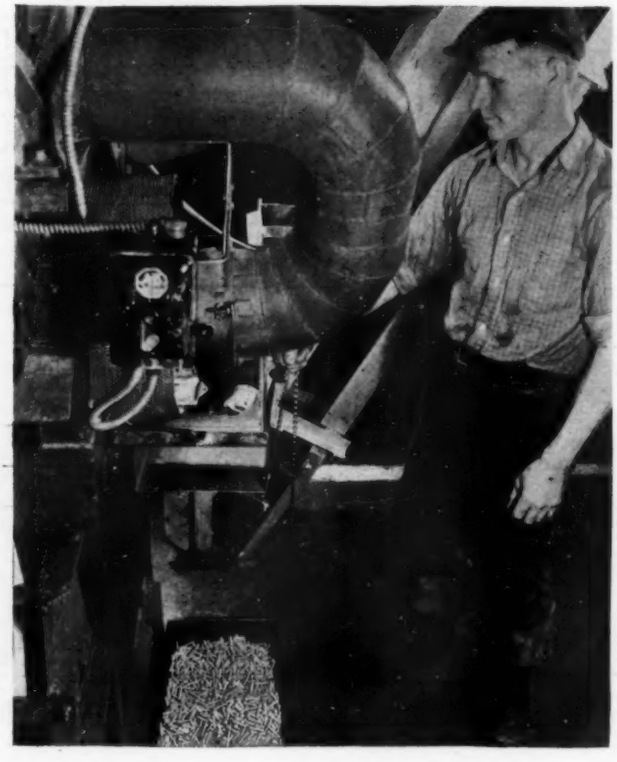


Fig. 4—A special finish-pass Type C electrode gives a very smooth bead, above. At right, sections cut from this six-pass weld in deep-grooved ¾-in. plate reveal the action of a Type C electrode



In addition to types given above, there is still another type with a heavy coating which is generally used with alternating current. This type, while mostly used with a.c., also works well with d.c. Its characteristics are also given in the table.



Three in One

CONSIDERABLE savings in the handling of parts from a plating department to an assembly department are made at the Delco-Remy Division of General Motors by use of a three-way delivery system fitted to the discharge end of a washing and drying machine. The machine is used for batch processing of small, medium and large parts. The largest part is a baseplate for voltage regulators, while the others are small brackets, terminal posts and similar-size pieces.

The baseplate is heavy and a belt conveyor has been installed to convey it directly from the washer to the assembly department. Tote boxes and barrels are used for intermediate storage and transfer of the smaller pieces to assembly. The three-way delivery device on the parts washer and drier operates as follows:

(1) With the gate swung up, regulator baseplates are dropped into a bin, from which they drop into the inclosed bucket conveyor that takes them up to the monitor and across the shop to the assembly department. There the pieces drop into storage hoppers at the correct point in the assembly sequence. This conveyor saves laborious trucking. (2) With the gate down, small parts put through the drier fall into tote pans. (3) With the entire device swung aside, the drier screen discharges directly into a barrel.

This adjustable gate installed at the discharge end of a washing and drying machine can be set to deliver cleaned parts into tote pans or barrels, or onto a conveyor

Special Set-Ups With Standard Tools

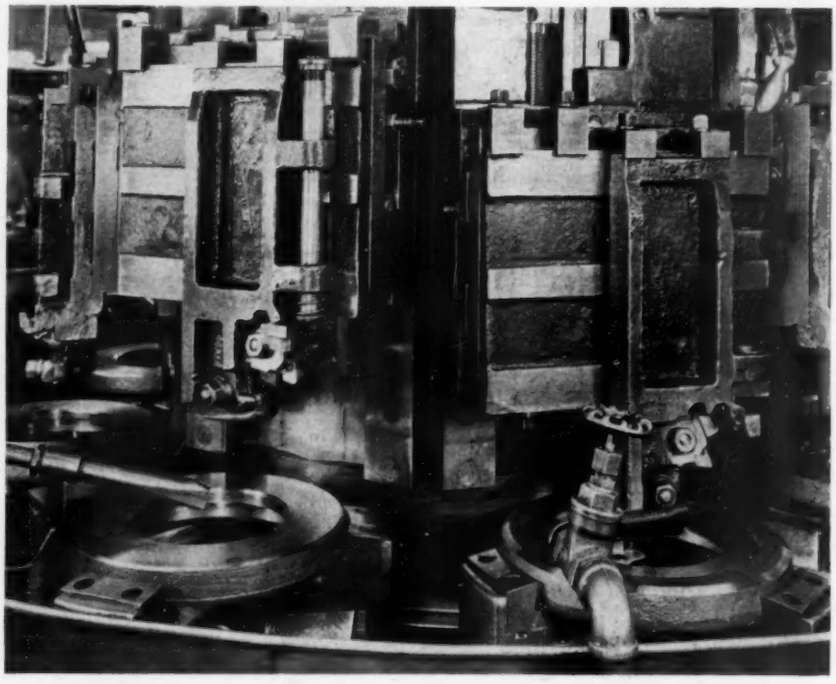
BY FRED W. LUCHT, ENGINEER, CARBOLOY COMPANY

Ford uses standard tool shapes, getting individual angles and rakes by special toolholders. New arrangement doubles output of blanks for truck gears

INCORPORATION of side and back rakes in toolholders rather than in the tools themselves has simplified grinding practice, aided standardization of tool types, helped tool production and reduced tool maintenance costs at Ford Motor Company. Worked out in connection with the production of SAE 4620 steel 226–286 Brinell ring gears for truck axles, the adoption of cemented carbide tooling has also increased production capacity of these parts materially by permitting increased cutting speeds and reducing down time through more pieces produced per grind.

Use of flat tools for all operations has been found considerably more economical, since the incorporation of side and back rakes in the toolholders necessitates an intricate compound angle set-up only once. After that, no further changes are necessary, while if side and back rakes are called for in the tools, the operation has to be repeated every time a new toolbit is made or reground.

Since tools are of the flat type they may be used interchangeably on other operations in the plant, thereby simplifying carrying of stocks of tools. Similarly, the number of grades of cemented carbide required has also been reduced, while maintaining maximum efficiency for mass production. For the ten ring gear operations, four grades are used. However, eight of the operations are performed with a single grade. Use of special grades for the remaining tooling is justified by the fact that this is a mass production job in virtually continuous operation, and maximum performance is there-



Setting tools after regrinding is simplified with plunger-mounted gages mounted on each toolholder

MACHINING DATA — RING GEAR BLANK

Tool No.	1	2	3	4		5	6	7	8	9	10
Operation	Chamfer O. D.	Rough Bore	Chamfer I.D.	Rough Form C'bore	Rough Face C'bore	Finish Bore	Rough Face Back	Finish Face Back	Chamfer Hole at C'bore	Finish Face C'bore	Rough Face Back
Grade of Carbide	1078	77-A	1078	77-B		1078	1078	883	1078	1078	1078
Spindle R.P.M	120	120	120	98	134	88	141	241	241	241	141
Spindle Ft. per Min	373	228	228	239	255–323	162	353–438	458–750	458	458–580	267–353
Feed, In. per Rev	0.008	0.008	0.008	0.0095	0.007	0.008	0.010	0.011	0.011	0.011	0.010
Depth of Cut, In	¼	⅛	⅛	⅛	1/16–⅛	0.017	¼	0.008–0.011	0.008–0.011	0.008–0.011	1
Average Pieces per Grind	403	817&674	846	347	339	3673	245	379	879	620	2
Average Grinds per Tool	25	22	22	27	28	20	25	25	20	25	25

fore essential. Elimination of semi-roughing operations by use of carbide tooling has also reduced total number of tools required for the series of operations from 19 to 13.

The present ring gear set-up, using eight-station machines with each station provided with tool set-up gages, has resulted in a floor-to-floor time of 75 sec. per gear. Operations consist of turning, facing, boring and chamfering. Approximately 5½ lb. of metal is removed per gear. Compared with the previous method of cutting these gears (using six-station machine equipped with special alloy tools) actual production per machine has been more than doubled.

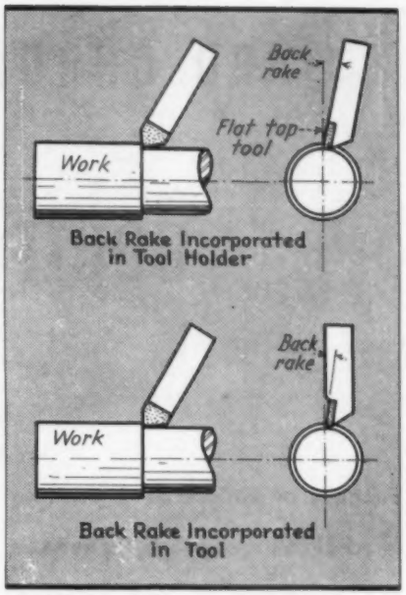
Special Gages Speed Setting

The accompanying tooling chart shows the set-ups for the various stations. Numbers adjacent to the tools refer to tool numbers in the table. An interesting arrangement has been worked out for quick setting and resetting of tools after grinding. In the illustration showing stations 5 (right) and 6 (left) there will be noted a plunger mounted in guides in the tool slide. For setting the tool, the plunger is pulled down and the gage block attached to its lower end is swung over under the tool. The adjustable collar at the top of the plunger insures setting of tools for correct depth of cut.

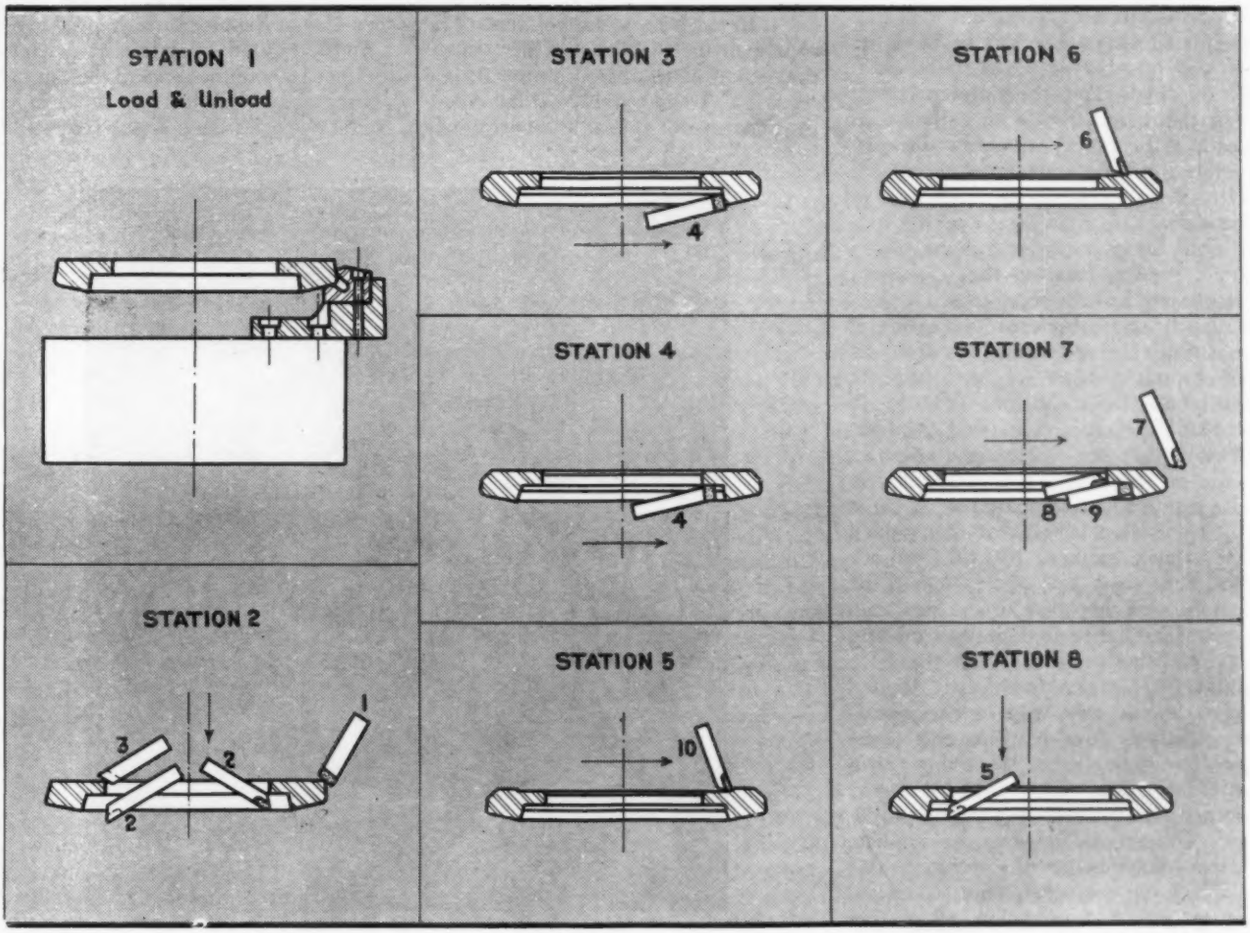
With these gages the required accuracy of 0.002 in. is maintained for tool setting, although the gages are capable of accuracies involving half that tolerance.

The problem of chip handling in connection with high production rates is simplified through large coolant flow directed so as to quickly chill and stiffen the chips. Thus the chips, when directed at the work, chuck jaws, or chip bank, readily break into short lengths for easier handling.

In this connection a larger than normal — 30-deg. — secondary clearance angle for the tools was found to be of benefit since it assisted in getting additional coolant to the tool point from below. As a result, not only did the tool tip run cooler, but dimensions were held to close tolerances, finish was improved and output increased.



Incorporation of rake in toolholders rather than in tools themselves simplifies grinding and aids standardization of tool types. Tool cost is also materially reduced



Floor-to-floor time for machining these ring gear blanks is only 75 sec. when using these tooling set-ups in an eight-station machine. Numbers refer to the tool numbers in the table

HARD CHROME FOR TOUGHER TOOLS—3

Control of Plating Baths

BY RAYMOND F. YATES

Success or failure in depositing hard chrome depends largely on the condition of the solution. Regular checks make corrective measures a fairly simple matter

WHILE CONSIDERABLE CONTROL must be exercised over a batch devoted to deposition of hard chromium, the situation need not impose very heavy duties on any member of the chemical staff. In the small plant, the tool department (if the hard chrome installation is made at this point) should need the assistance of the chemical department only in establishing the bath and in maintaining it in an ideal working condition. Daily operation can be placed on a routine basis so that consistent results are usually obtained.

In the first article of this series, it was stated that a chromic bath of 40 oz. of chromic acid per gal., with sulphate (sulphuric acid content) of 0.55 to 0.58 oz. per gal., is a good solution. This figures out as having a sulphate ratio of 73:1. This is a comparatively low ratio when compared with baths used for decorative chromium, which may run as high as 100:1. Opinions will vary on this point, but it is to be emphasized that some of the most successful hard-chrome deposits are being accomplished in baths with the 73:1 ratio. Whatever ratio is finally decided upon should thereafter be maintained as closely as possible to insure greatest uniformity in results. If the above ratio is employed, it will be found that gray rather than the more healthy bright deposits are obtained when the sulphate drops much below the recommended values. On the other hand, when the chromic acid drops below 38 oz. per gal. the plate has an aggravating tendency to burn and peel.

Aside from temperature control, hard chrome bath testing may be divided into three classes: the first having to do with chromic acid content, the second with sulphate content and the third with the determination of trivalent chromium.

1. Most chromic acid determinations are conducted by the simple use of a Baumé hydrometer to measure specific gravity. This test should be run after the solution has been out of service for a period sufficiently long to permit it to reach room temperature. The accompanying table provides direct conversion figures based on the Baumé readings. To the highly skilled chemist, this may not appear as an extremely accurate determination, but long experience with chromium solutions proves that more elaborate examination is not necessary.

If the solution falls below the minimum set, the attendant can add chromic acid to bring it to strength. This is, however, not merely a matter of dumping chromic acid crystals into the chrome tank. Without agitation, these would merely drop to the bottom of the container and remain there until they slowly dissolved away, producing a highly saturated solution at the bottom but leaving the top and the normal plating zone with little or no change. Agitation to facilitate dissolving would

An inexpensive centrifuge is the most elaborate piece of equipment needed to determine the sulphate ratio of chromic acid baths

Chromic Acid Content, Based on Baume Hydrometer Readings

Deg. below	Oz. per gal.-CrO_3	Deg. below	Oz. per gal.-CrO_3
1.50	2.2	19.00	29.0
2.00	2.8	19.50	29.8
2.50	3.4	20.00	30.6
3.00	4.1	20.50	31.5
3.50	4.8	21.00	32.4
4.00	5.5	21.50	33.3
4.50	6.2	22.00	34.2
5.00	6.8	22.50	35.1
5.50	7.5	23.00	36.0
6.00	8.2	23.50	37.1
6.50	8.9	24.00	38.2
7.00	9.7	24.50	39.1
7.50	10.4	25.00	40.0
8.00	11.1	25.50	40.9
8.50	11.9	26.00	41.9
9.00	12.6	26.50	42.9
9.50	13.4	27.00	44.0
10.00	14.2	27.50	45.0
10.50	15.0	28.00	46.0
11.00	15.8	28.50	47.1
11.50	16.5	29.00	48.2
12.00	17.3	29.50	49.2
12.50	18.2	30.00	50.2
13.00	19.1	30.50	51.5
13.50	19.8	31.00	52.7
14.00	20.4	31.50	54.0
14.50	21.2	32.00	55.2
15.00	22.0	32.50	56.3
15.50	22.9	33.00	57.5
16.00	23.7	33.50	58.7
16.50	24.5	34.00	60.0
17.00	25.4	34.50	61.2
17.50	26.3	35.00	62.3
18.00	27.2	35.50	63.5
18.50	28.1	36.00	64.8

only stir up the accumulated matter at the bottom of the tank, and many hours would be required for this sludge to resettle.

Perhaps the best procedure is to dissolve the additional chromic acid crystals in an independent container filled with hot water. Here, however, the relationships must be carefully predetermined so that the ratio will not be unduly violated.

2. Sulphate (or sulphuric acid) tests are of great importance to chrome baths. Good regulation and continued uniformity can be obtained only by periodic examination with approved apparatus and approved methods. The sulphate ratio is really quite critical, and the throwing power of any chromic acid bath, at best bad, is made still worse unless sulphate regulation is good. It must also be borne in mind that, in the case of chromium, the metal is plated out from the solution and does not come from the anodes as in the case of nickel.

Providing the proper equipment is at hand, a routinized sulphate test can be established without the services of a chemist and with every assurance of sufficient accuracy. For this work a small centrifuge is necessary. This can be secured (with accessory apparatus intended only for use in connection with chromic acid baths) for about $25. It is used to precipitate barium sulphate, the quantity indicating the sulphate content of the bath. The exact procedure is as follows:

The amount of precipitated barium sulphate is easily determined from the graduations on the centrifuge tube constriction

To 5 cc. of 1:1 hydrochloric acid is added 20 cc. of filtered sample from the bath. To this is added 5 cc. of a saturated barium chloride solution and the whole mixture is shaken. The sample is then permitted to stand for exactly one minute before it is placed in the centrifuge with another tube for balance.

After the tube has been spun for one minute at high speed, the machine is stopped and the barium sulphate accumulated in the constriction at the end is measured. The tube is spun for 15 sec. again and another reading taken. The operation is repeated, and if no change in the level of the barium sulphate has occurred it can safely be assumed that the reaction has ceased. The reading is then simply multiplied by 0.136 to get the number of ounces of chromic sulphate per gallon of solution.

If the sulphate content is too high, barium carbonate in powder form is added directly to the bath. It is simply thrown on top of the solution. If, for instance, the sulphate runs 0.43 in place of 0.33, then 0.2 oz. per gal. of barium carbonate is added.

3. An excessive amount of trivalent chromium in any plating bath is bad, and frequent tests must be made to insure a minimum of this undesirable ingredient. An excess of this material greatly narrows the bright plating range of any solution and seriously increases its resistance. Such a bath will spoil a great deal of work, its throwing power will be poor, and it will, for other reasons, be expensive to operate.

Several factors in the operation of a chromium bath may accelerate the formation of trivalent chromium. Operating the solution for long periods of time with an unbalanced anode-to-cathode surface ratio often contributes heavily to the formation of trivalent chromium. The presence of organic material, often used as binder in buffing compositions, also assists in the formation of such matter.

A simple kit that will enable a person untrained in chemistry to make a quick determination of trivalent chromium can now be bought for less than $10. It utilizes a method of color comparison. The chromic acid content must first be determined. This content indicates, according to a set formula supplied with the equipment, how much of the solution must be placed in a test tube. Water is then added and the color matched with a standard. Color tubes are supplied with the outfit and each represents 1 per cent. The range 0–7 per cent is accommodated.

Chemical analysis requires a much longer time but is, of course, far more accurate than the method noted above. Nathaniel Hall and G. C. Hogaboom, Jr., recommend the following proce-

dure in analyzing for trivalent chromium:

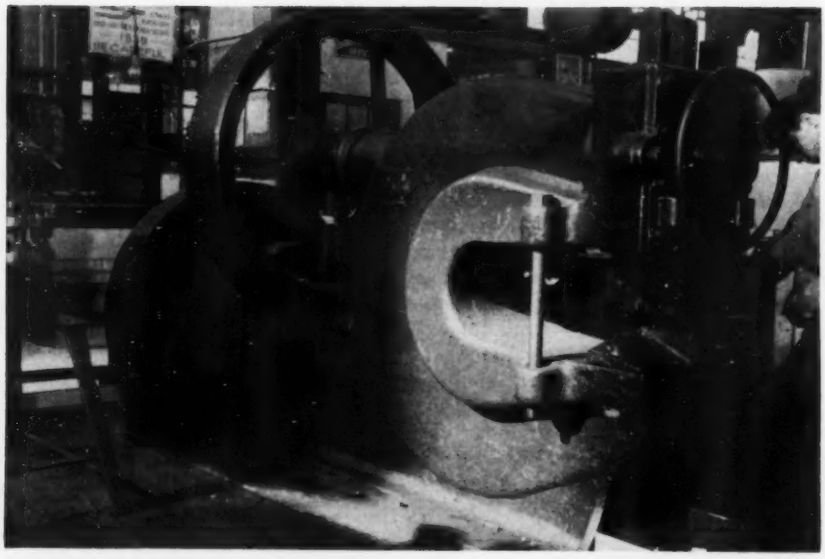
1. Pipette a 10-cc. sample into a 400-cc. beaker and add 200 cc. of distilled water.
2. Add a slight excess of ammonium hydroxide (NH_4OH) and boil. Allow to settle and filter.
3. Wash precipitate with hot distilled water and dissolve with 25 cc. of 10 per cent sulphuric acid (H_2SO_4) solution.
4. Add excess NH_4OH and 25 cc. of 10 volume hydrogen peroxide (H_2O_2). Boil for 15 minutes.
5. Filter to remove iron and add 20 cc. of 30 per cent potassium acid sulphate ($KHSO_4$) solution to the filtrate. Boil for 15 minutes.
6. Add H_2SO_4 until neutral and then add 5 cc. excess. Add about 2 gm. of solid potassium iodide (KI) and after 5 minutes titrate with standard 0.5 N. sodium thiosulfate ($Na_2S_2O_3 5H_2O$) until the brown color begins to lighten.
7. Add 2 cc. of 1 per cent starch solution prepared by making a paste of 1 gm. of starch with very little water and adding it to 100 cc. of boiling distilled water, and continue titrating until the blue color disappears for about one minute. The standard thiosulfate is prepared as follows: Dissolve 125 gm. of sodium thiosulfate in water and dilute to one liter. Exactly 0.50 gm. of C.P. potassium dichromate ($K_2Cr_2O_7$) (containing 0.177 gm. of chromium) is weighed out and dissolved in 100 cc. of distilled water. 2 gm. of KI is added and after 5 minutes the solution is titrated with thiosulfate and starch indicator as above. One cc. of 1.0 N. sodium thiosulphate is equivalent to 0.01733 gm. chromium. Therefore the normality of the thiosulphate is equal to 0.177 ÷ (cc. of $Na_2S_2O_3$ required for 0.50 gm. $K_2Cr_2O_7$) × 0.01733. This equals 10.2 ÷ (cc. $Na_2S_2O_3$ required for 0.50 gm. $K_2Cr_2O_7$).

The trivalent chromium in oz. per gal. is equal to:

2.25 (cc. of $Na_2S_2O_3$ solution required for sample) ÷ (cc. of $Na_2S_2O_3$ solution required for 0.50 gm. of $K_2Cr_2O_7$).

Fortunately, excessive amounts of trivalent chromium may be removed by a fairly simple operation. Several porous clay pots are hung in the bath when it is not in use. In the center of each pot an iron anode is suspended. The bath is actually operated over night with this arrangement. The trivalent chromium in the bath will, under the circumstances, be oxidized to chromic acid. If the solution in the cup acquires too heavy a concentration of trivalent chromium, there may be a precipitate of chromium chromate. At intervals, therefore, the solution in the cup is thrown away and replaced with more solution from the bath.

Shears That Built the Merrimac



Plates for the Merrimac *of Civil War fame were trimmed and punched in this machine, installed at the Norfolk Navy Yard in 1860. Although retained as a museum piece, it has been motorized and is still used occasionally for cutting bolts and rivets*

WE OFFER the illustrated punch and shears for top honors in age, dramatic service and historic background. The Confederates used it in 1861–1862 to build the ironclad *Virginia* (*Merrimac*). It was still in use when the battleship *Texas* and the cruiser *Raleigh* were built in 1889–1895, and today is cutting rivets for recent naval vessels.

The date 1860 can still be seen plainly on the cast iron C-frame. The federal government installed it in that year to cut plates, bolts and rivets for the line-of-battleship *Pennsylvania,* the sailing frigates *Columbia* and *Raritan,* and the steam frigate *Merrimac.* It was one of the few pieces of machinery left usable when the federal forces evacuated the Norfolk Navy Yard during the night of April 20, 1861.

An eye-witness account of the evacuation states: "On the morning of the 20th of April, 1861, this establishment was the best equipped and in all respects the most complete navy yard in the country. On the morning of the 21st of April it was a mass of ruins. . . . The steam frigate *Merrimac* was sunk and burned to her copper line, and down through her berth deck, which with the spar and gun-decks were also burned. . . ."

When the *Merrimac* was rebuilt as the ironclad confederate *Virginia,* the shears here shown were one of the few machines in the yard in serviceable condition. It played a major part in forming and punching the plates for the forerunner of all modern naval vessels which fought the memorable battle with the Monitor in 1862 in Hampton Roads. It did its share of work in building the white fleet which saw service in the Spanish American war, and was still in use during the heavy naval-construction period between 1917 and 1919. It was motorized at that time. When the new structural shop at the Norfolk Navy Yard was built, the shears were retained as a museum piece, but found occasional use in cutting rivets to length. Many rivets for some of the most recent naval vessels were and still are being sheared to length on this machine.

Jump Cutting a Helix

An elaborate set-up for such a simple job? But it wasn't so simple. Hence the arrangement shown, which produced aplenty

SMALL CONDUIT FITTINGS made by W. F. Curlee Manufacturing Company, required a "fast" helix on one end. Since extreme accuracy could be sacrificed for high production, malleable castings were at first tried, but without success. Further trials indicated they could be turned from standard pipe, and it was decided to jump cut the helix rather than chase it, as machining time was an important factor.

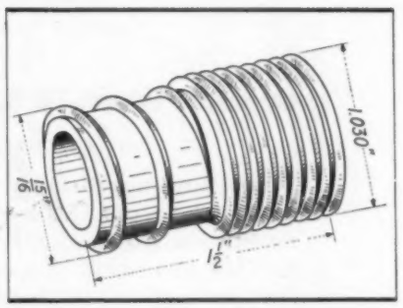
As finally tooled up, the job was done on a Model B Pratt & Whitney lathe. Machining the $\frac{1}{3}$-in. lead helix, or convolution, on an O.D. of $1\frac{5}{16}$ in. with the set-up shown resulted in an average output of about 65 parts an hour, with a maximum of 85. Operations are: (1) thread pipe end, (2) turn coarse helix, (3) smooth hole on thread end, (4) chamfer thread, and (5) cut off.

Pipe is fed through jaws beyond length of work and pushed into position by a step inside the expanding die head. Chuck jaws are then closed. After the thread is cut, tool *A* turns the outside diameter and tool *B* forms the helix, while the end of the hole is beveled by a hand tool supported by the die head and fed by a lever. Burrs are filed while the helix is being cut. As soon as the feed ends against a limit stop and before the carriage is disengaged, the fitting is cut off by tool *C* and the next fitting chamfered by a tool in the cross slide.

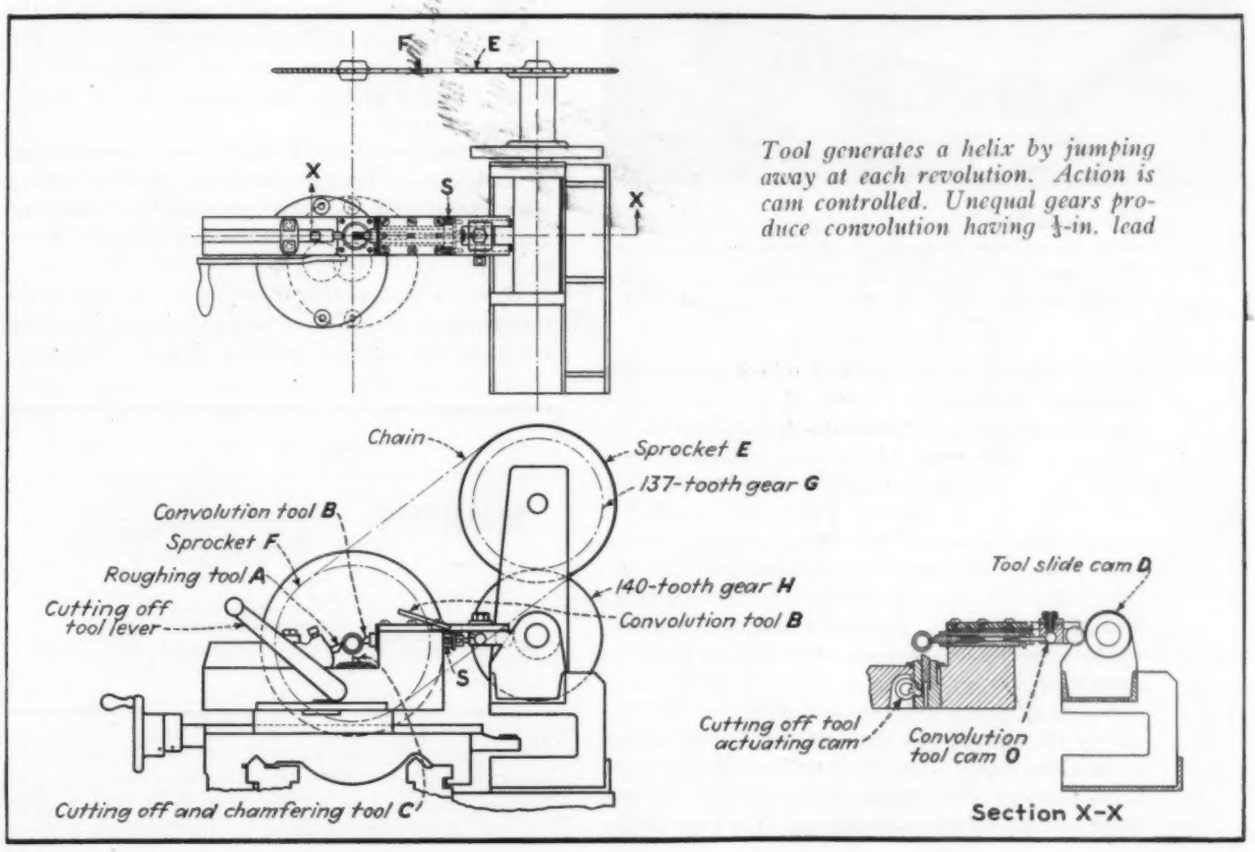
Cam *D* at the back of the lathe actuates the tool slide through the 1-in. roller, the slide being kept against the cam by spring *S*. The small, flat-sided cam *O* allows the tool to be withdrawn from the cut when its flat side is turned toward the tool. The main cam has a lift of $\frac{1}{16}$ in., which is the height of the convolution.

To cut the helix with a lead of $\frac{1}{3}$ in., cam *D* must make three revolutions less than the spindle while the carriage feeds one inch. With 1/140th of an inch as the feed, gear *H* has 140 teeth, gear *G* 137 teeth, and sprockets *E* and *F* the same number of teeth, in this case 26. For a lead of $\frac{1}{2}$ in., gear *G* would have 138 teeth.

Other applications of this principle will undoubtedly arise from time to time. Where it can be used, its speed makes it a real production method.



Jump cutting the helix at left, instead of chasing it resulted in greatly increased production without sacrificing too much accuracy



Tool generates a helix by jumping away at each revolution. Action is cam controlled. Unequal gears produce convolution having $\frac{1}{3}$-in. lead

IDEAS FROM PRACTICAL MEN

Locomotive Exhaust Tip Made by Welding

BY ARTHUR HAVENS

Fabricated steel is rapidly replacing heavy ponderous cast-iron parts. This is especially true on the railroads where economy and long wear of locomotive parts are paramount. A splendid example of fabricated steel replacing cast iron is found in the illustrated all-welded steel exhaust-tip blower ring.

The construction of the all-welded exhaust nozzle, or tip, embodies simple shearing, rolling and welding technique. The base is a square of $\frac{1}{2}$-in. boiler plate made the same outside dimensions at the top of the exhaust base. The center of this plate is flame cut to a diameter of $\frac{13}{16}$ in. larger than the desired inside diameter of the tip. A strip of $\frac{3}{8}$-in. plate is rolled to proper inside diameter and taper according to the print. This is assembled in the opening of the base provided for it, leaving enough of this protruding through the bottom to machine a suitable seat. Afterwards, it is welded in place with a good grade of down-hand heavy coated rod.

This all-welded locomotive exhaust nozzle tip is made by rolling, shearing, and flame cutting boiler plate, and fabricating the assembly by welding. The welded nozzle replaces one of cast iron

A ring is rolled and welded together to form the outside of the tip; this strip also makes the outside of the blower ring. The ring is made from $\frac{1}{4}$-in. plate, has a diameter that leaves $1\frac{1}{4}$ in. between the two rings, and is welded inside and out. The ring for the top is now sheared or flame cut to size, laid in place and welded securely.

All that is needed to complete the tip is to weld four triangular pieces to the top, placed 90 deg. apart. The triangle pieces are to create pockets in the exhaust steam to entrap the front-end gases and create a more perfect vacuum in the front end. A $1\frac{1}{2}$-in. pipe nipple is welded into the steam chamber on the side to furnish pressure for the blower ring.

The tip is then machined; the seat is faced in a lathe, the bolt holes are drilled and eight equally spaced $\frac{3}{16}$-in. holes are drilled in the top for the blower.

With the steel exhaust nozzle it is a comparatively easy matter to increase or decrease the size of the tip and adjust it to varied exhaust conditions.

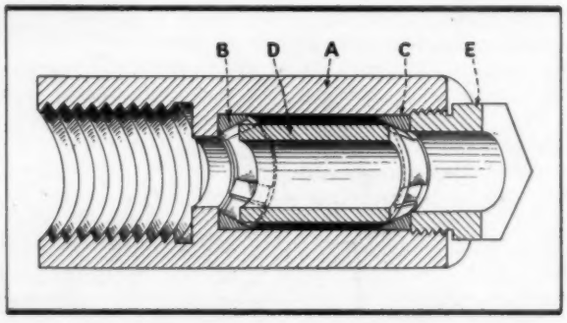
Grinding Chuck Centers Bushings Quickly

BY MARTIN H. BALL

The chuck shown in the drawing is used to finish grind the bore of hardened bushings. It was made to chuck automatically bushings that become distorted during hardening. The body *A* was made to fit the spindle of a Brown & Sharpe universal grinding machine, and was screwed onto the spindle nose for finish grinding its bore and seat fit for the bottom chucking ring *B*.

The chucking rings *B* and *C* were given about $\frac{1}{64}$ in. clearance between the three finished bearing seats. They are made from tool steel, hardened and ground finished, and are a close sliding fit in the body *A*.

With the bottom ring *B* resting on the seat at the bottom of the bore, the bushing *D* is inserted and followed by the outside chucking ring *C*. The angle



Hardened bushings can be centered quickly in this chuck for grinding the internal diameter. The bushing is held against chucking rings which offer three-point bearing for the bushing

faces of the chucking rings *B* and *C* present three-point bearing on the ends of the bushing when pressed home by the hollow nut *E*, thereby automatically adjusting for any distortion at either end of the bushing.

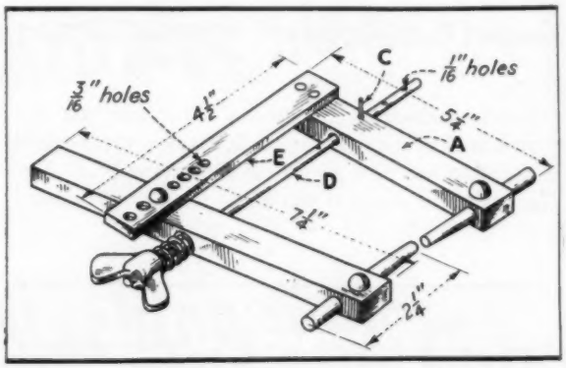
The bushing and outside ring are removed when finished by unscrewing nut *E* and hooking a bent wire back of bushing *D*. Final outside grinding is done on centers, with the bushing pressed lightly on a standard arbor for this operation.

Fixture Has Carbon Clamp for Welding Small Work

BY H. R. HAGEMAN

When welding or brazing a variety of small parts, the illustrated adjustable clamp, which has carbon sticks for the holding fingers, can be used. The area required for clamping is a minimum and the heat from the flame or arc will not expand the clamp; consequently, during welding, the parts remain in the position they were set while the clamp was cold.

The fingers which come in contact with the flame or arc are carbon sticks salvaged from flashlight bat-



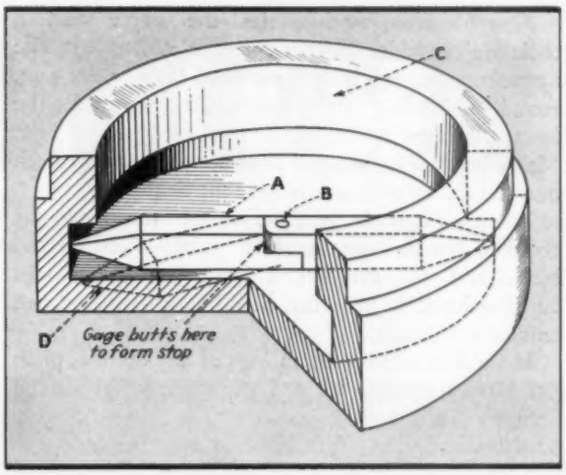
This welding clamp, with carbon holding fingers, can be used for welding and brazing small parts. Expansion of the work, as well as the clamp, will not decrease the clamping pressure

teries. These are held in the main members of the clamp by setscrews as shown. The two main members are of ½-in. square cold rolled steel, which pivot about pin *C* through *A* and *D*. The opening of the clamp can be adjusted by holes in the rod *D* and the connecting arm *E*, the latter of which is riveted to main member *A*. The spring and wing nut on rod *D* take care of natural expansion of both the work and the fixture during welding.

Hinged Pin Measures Diameter Relief

BY THOMAS DAVIES

The pin gage shown in the drawing was designed to measure the diameter relief in bored parts to a tolerance of ±0.002 in. The gage *A* is square in section, except at the ends where is is rounded and tapered



This pivoted pin gage was designed to measure the relief diameter in bored work. The two halves of the gage pivots about a central pin, and will align themselves perfectly when the proper relief is obtained

toward the nose. The gage is made in two parts, shouldered at the center, and attached by pivot pin *B*.

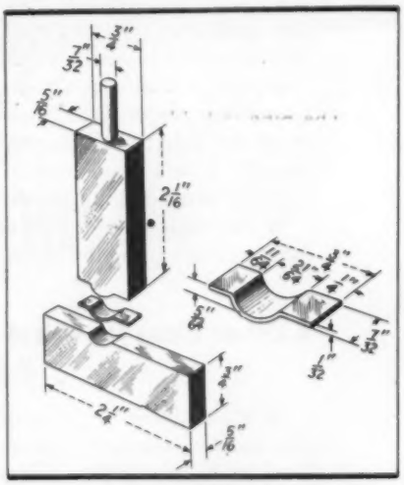
When the gage is bent to enter bore *C* and assumes the position shown at *D*, when opened in the relief of the work, the relief is obviously too small. The gage must be opened perfectly straight as shown at *A* when the correct relief is obtained.

Simplified Forming of Small Flat Springs

BY J. F. CAVANAGH

Small flat steel springs of special shape, sometimes demanded in a sample lot of devices, are usually formed tediously with pliers, vise and hammer or by improvised forming dies in the foot press. All such springs, especially very thin ones, are subject to distortion hardening.

The method herein described has proved a great time saver in the production of a small lot of springs, is applicable to spring steel up to 0.040 in. thick, and is especially efficient on very thin stock. A light drill press is suitable for the forming operation. The drawing shows a representative flat spring of special shape, and tools for forming it.



Small flat steel springs can be formed in the drill press by heating the stock and locating it between the blocks. Upon withdrawal it will be glass hard, after which it may be drawn to the proper temper

First file from machine steel the simple forming tools slightly wider than the spring to be formed. The upper member or punch is provided with a stem ¼ in. round for holding in the drill chuck. Simply let the lower block rest on the plate or hold it in a drill vise. Means for heating the end portion of the spring stock must be set up temporarily near the drill press.

When all is ready, heat the end of the stock to the required temperature, locate it quickly between the blocks and close the dies. Upon withdrawal, it will be glass hard. It may then be oil-flash tempered and trimmed to length.

In the case of thin flat springs of any outline, plain flat blocks are utilized and the springs are placed between them with tweezers. They will invariably harden true and may be drawn on a flat plate.

In the case of a thin steel diaphragm, no attention need be given to the flatness of the stock since the flat steel blocks will give the hot plastic steel a perfect surface co-incident with the hardening.

Ball Bearing Guides Drill to Blind Hole

BY NOAH DEERING

Very often, in the machine shop, it is necessary to drill a collar or sleeve that has been pressed or shrunk on a large pipe. Usually the pipe has been drilled for the part that was in place previous to the fitting of the new collar. Such a job is found in the replacing of worn or broken locomotive dry pipe collars or elbows. The common practice is to lay out the holes in the collar and hope to hit the inside holes when drilling, which usually results in elongated holes. This can be eliminated by the following procedure:

Strap a heavy bar to the drill press table leaving enough protruding to hold the part to be drilled. Spot this bar with the point of the drill so that it will be large enough to hold a ¾-in. ball bearing. The dry pipe with the collar in place is slipped onto the bar and one of the inside holes placed on the ball bearing. The pipe is held squarely in place by a strap and a hole of the proper diameter drilled through the collar. After the hole is well started, the bearing can be removed. It is a good plan to mark the drill at this depth to avoid dulling the drill on the bearing.

If the collar is to be riveted it can be done in the same position, using the bar as a hold-on for the rivets.

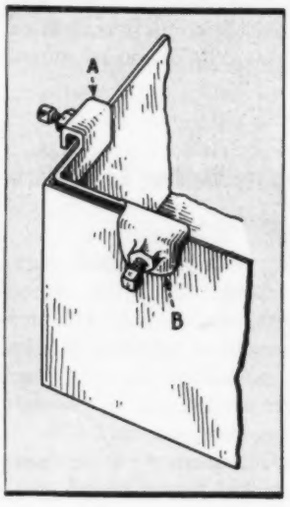
A Corner Clamp for Welded Assemblies

BY A. H. CARROLL

When aligning the corners of plates for welding, it is usually necessary to use a clamping device to hold them in position. Many different clamps are employed for this purpose, but one of the simplest and easiest to apply is shown in the illustration.

Although it can be made any size desired, one made from ⅜x3-in. plate 12 in. long seems to serve the average requirement. When laying out, two ears *A* and *B* on each end of the clamp are planned; these are about 1½ in. square with $\frac{9}{16}$-in. holes drilled centrally before bending. The body of the clamp is bent exactly 90 deg.

The ears are bent at 90 deg. in two places, leaving a ½-in. space between the ears and the bar. Then ½-in. nuts are welded over the holes, and ½-in. setscrews are placed in the nuts. The corner clamp is now ready for use and will be found indispensible for the fabrication of all types of square or cornered articles.

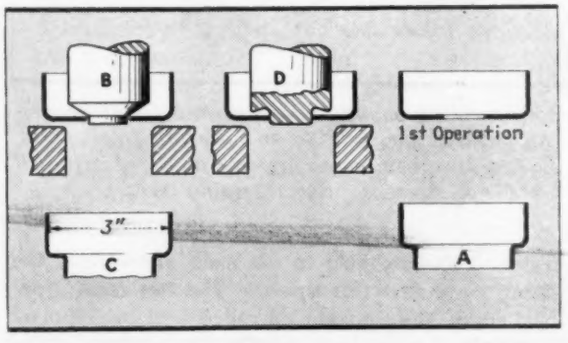


A clamp bent as shown and fitted with nuts and setscrews can be used to weld all types of square or cornered articles

Recessed Punch Eliminates Fractures and Wrinkles

BY PETER L. BUDWITZ

In the manufacture of round shells like the one shown at *A* in the drawing, difficulty was experienced in forming the neck in the final-operation die. The punch and die shape *B* was being used, which caused fractured corners and unevenness along the bottom edge *C* of the shell. The material used for the parts was 0.062-in. strip steel. Annealing the stock did not alleviate the condition.



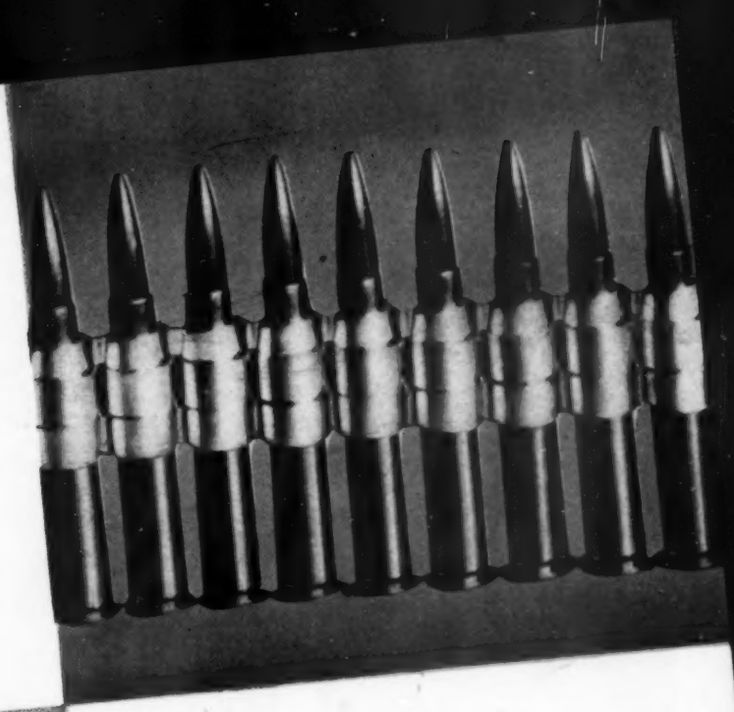
Fractures and wrinkles found in this shell after drawing were eliminated by redesigning the punch, using a recessed, rather than beveled punch face to pinch the corners of the stock

The punch and die was altered to the shape shown at *D*. With this punch the stock is first pinched at the corners and pushed through the die ahead of the punch. This simple change in shape overcame all difficulty.

Armament

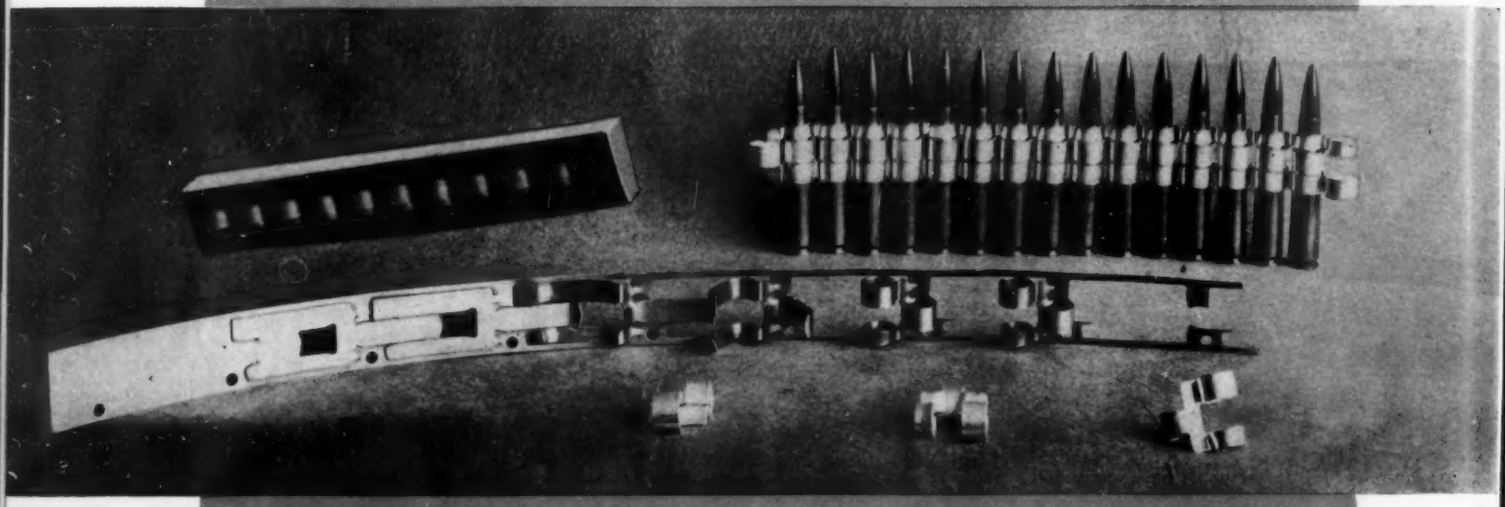
SECTION OF AMERICAN MACHINIST

Cartridge Links *for* Machine Guns



Flush Rivets *for* Speedy Airplanes

CARTRIDGE LINKS FOR MACHINE GUNS



Increased fire power from machine guns places severe demands on all parts concerned—including cartridge belts. Ingenious looped links join the cases into an accurate, trouble-free assembly. Manufacturing them involves some intricate die and inspection set-ups

SOME EIGHT OR TEN years ago the job of making a metallic feeder belt for machine guns and automatic rifles was considered to be almost impossible from the production viewpoint. At that time the Rock Island Arsenal began a new study of the problem and in conjunction with Quality Hardware & Manufacturing Company, of Chicago, developed a die which did the necessary forming operations progressively in a total of eight stations. Prior to that time the operations had been performed with individual dies in several presses with consequent low production, thereby making cost of individual links prohibitive.

However, the design of the progressive type die, to be described later, eliminated the difficulties of accurate forming and multiple handling, thereby increasing production. Improvements in methods of heat-treating were also of great assistance in bringing production up to the high point that the Rock Island Arsenal has reached today on this necessary item.

Importance of the following prescribed details in the manufacture of the links, Figs. 2 and 3, cannot be over-emphasized, since any defect can stop the functioning of the weapon and render it useless at a critical time. Strict adherence to materials specifications, dimensions, heat-treatment and inspection is important.

The links are formed from cold rolled strip steel of the following composition: carbon, 0.59–0.74 percent (0.65 preferred); manganese, 0.40–0.60 (upper range preferred); silicon, 0.30 maximum; phosphorus, 0.04 maximum; sulphur, 0.05 maximum. This steel must have physical properties of 65,000 lb. per sq. in. minimum tensile strength, 20 percent minimum elongation, 75–82 Rockwell B hardness. The structure must be completely spheroidized with no evidence of free lamellar pearlite, Fig. 4. Surface

decarburization should not exceed more than 0.0005 in. maximum.

Following is the method used at Rock Island Arsenal in manufacturing both 30- and 50-caliber metallic belt links. The only difference between the two links is one of gage and over-all dimensions, Figs. 2 and 3. Manufacturing procedures are identical in all major respects.

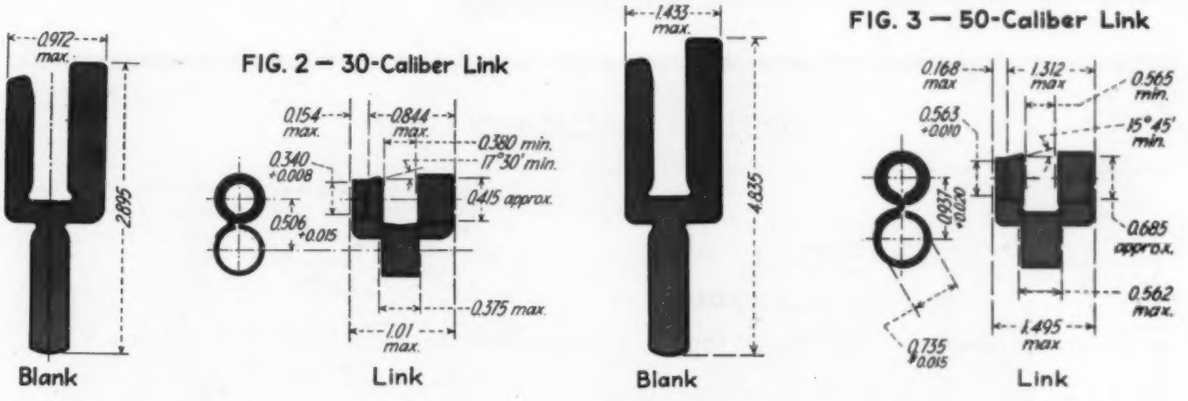
When starting a new coil of stock, the starting end must be trimmed and the stock for the first 5 ft. straightened. A small bench type arbor press equipped with a trimming die is used for the trimming operations. A hand-operated roll shown on top of the feeding mechanism, Fig. 6, straightens the strip before it is placed in the feeder roll.

Henry & Wright dieing machines are used for the forming operations. A 50-ton machine with a 4¼-in. stroke is used for the 30-caliber links with a maximum production rate of about 100 to 115 per min. A 60-ton machine with a 5-in. stroke is used on the 50-caliber links with a maximum production of about 60 to 70 links per min. The machines are motor driven through Reeves variable-speed controls.

The feed rolls (Fig. 5) on the machine had to be supplemented by the synchronized power feed (Fig. 6). A non-synchronized condition between roller feed and power feed will cause jerking of stock strip. This condition causes inaccuracies in the progressive die.

A variable-speed motor drives the stock reel at a

Fig. 1—(opposite)—Stock strip showing die operations in the manufacture of the links, a belt composed of cartridges and links, and a box of links as shipped to the field



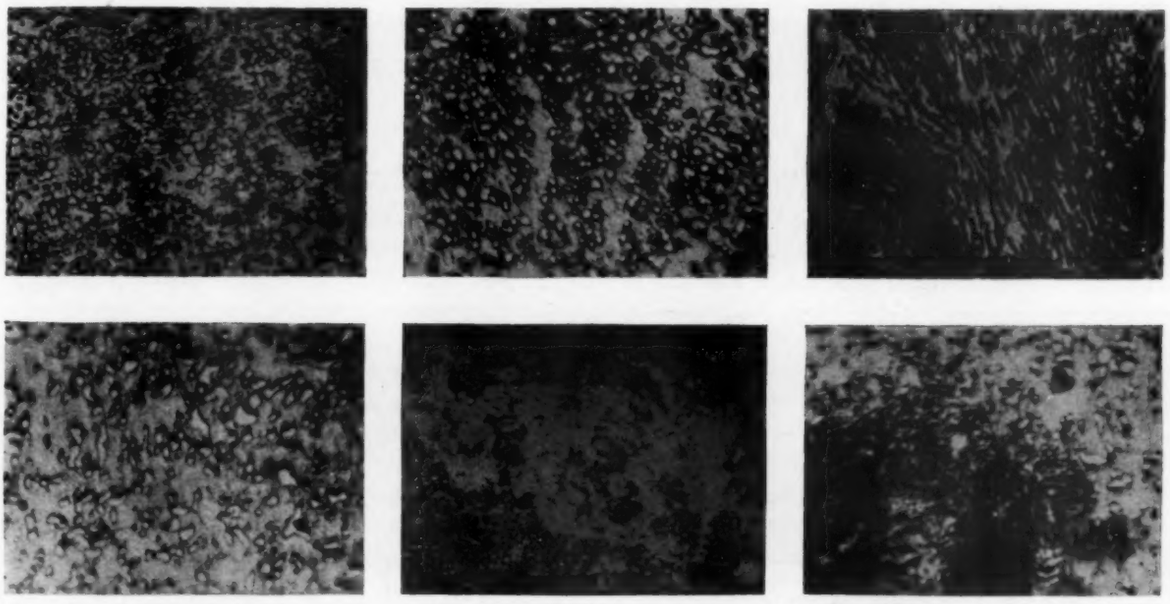


Fig. 4—Spheroidized structure of strip steel for belt links with desirable structure at left, undesirable structure of massed ferrite at center, and unacceptable structure of pearlite crystallization at right

constant speed, regardless of its diameter, through a worm gear reducer and chain drive to the supporting rollers. Thus the feed roll on the dieing machine is not affected by the inertia of the roll and the intermittent jerking as it turns. Fig. 6 shows the details of this feeding device.

The progressive die shown in Figs. 7 and 8 is made up of eight units, any one of which can be replaced when required. Of particular interest in this die, the feature which makes it operate as well as it does, is the stock carrier plate which lifts the stock in and out of the die. The carrier plate is suspended on springs which lift the carrier plate from the die, making the stock ready for feeding to the next station. Pusher springs on the top force it down into position for punching operations.

Another interesting feature which also makes for successful operation of the progressive die is a dog-leg cam which actuates the mandrels around which the links are formed at stations 6 and 7. This cam forces the mandrels across the strip before the carrier plate descends.

The links drop into tote pans at the end of the dieing machine ready to be transported to the heat-treating. Samples from the tote pans are inspected for dimension and general workmanship.

Heat-Treating Is Continuous

The present method for heat-treating the cartridge belt links is shown schematically in Fig. 11. The electric hardening furnace has a reciprocating charger which drops the links on a belt inside the furnace. The chute—originally placed about an inch above the moving belt—had a tendency to strike the bed of links on the slowly moving belt. Being in the hot zone of the furnace, many links were spoiled. It was necessary to raise the end of the chute to a higher level above the belt. To secure an even amount of

ROUTING—30-CALIBER LINKS

Operation	*Equipment*	*Number of machines or operators for production of approximately 125,000 links per 8-hr. shift*
1. Trim ends	Arbor press and die	1
2. Straighten stock	Hand roll	1 for each press
3. Form complete	Henry & Wright dieing machine and progressive die	2 machines
4. Inspect	Go- an : not-go gage	
5. Degrease		
6. Heat-treat—1,500 F., 22-min. cycle	G.E. three-zone electric conveyor type furnace	1
7. Quench	Oil tank with steel mesh belt conveyor to washer	1
8. Wash	Tank with mesh belt conveyor to draw furnace basket	1
9. Draw—530 F. (550 F. for 50-caliber) 60-min. cycle	Homo furnace	1
10. Shotblast	Wheelabrator or Tumblast (No. 60 shot, 60 lb. per sq.in. air pressure)	2
11. Pull, twist and extraction test samples	Special fixtures	
12. Zinc plate (*a*) strip test (*b*) salt spray test	Plating tank	6 barrel
13. Bake—3 hr. at 450 F.	Homo furnace	1
14. Inspection — 100 percent dimension and pull	Special fixtures and gages	10 men
15. Pack 20 links per carton (10 of 50-caliber links)	Special fixture and paper break for cartons	2 men

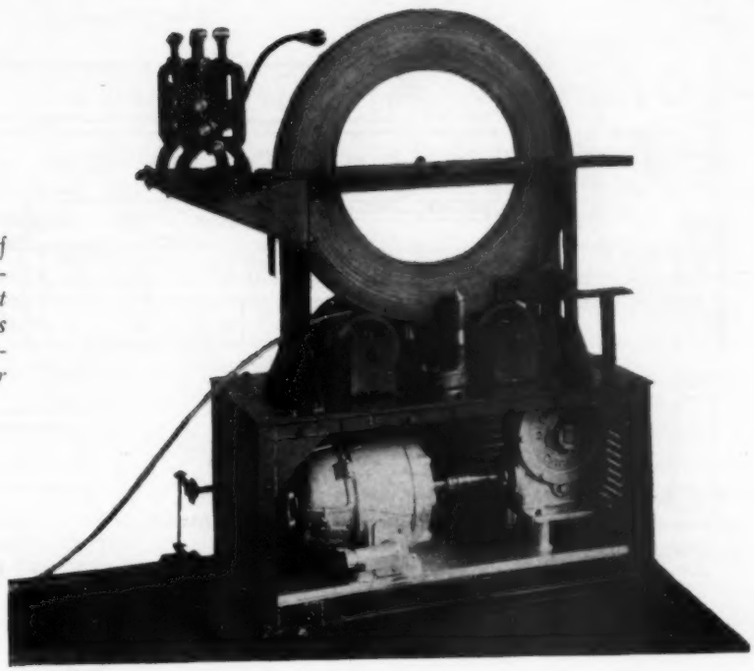


Fig. 6—To eliminate jerking of the strip as the stock roll unwinds, and to assure a constant rate of feed, this power drive was devised. The variable-speed motor is controlled by a hand lever at the dieing machine

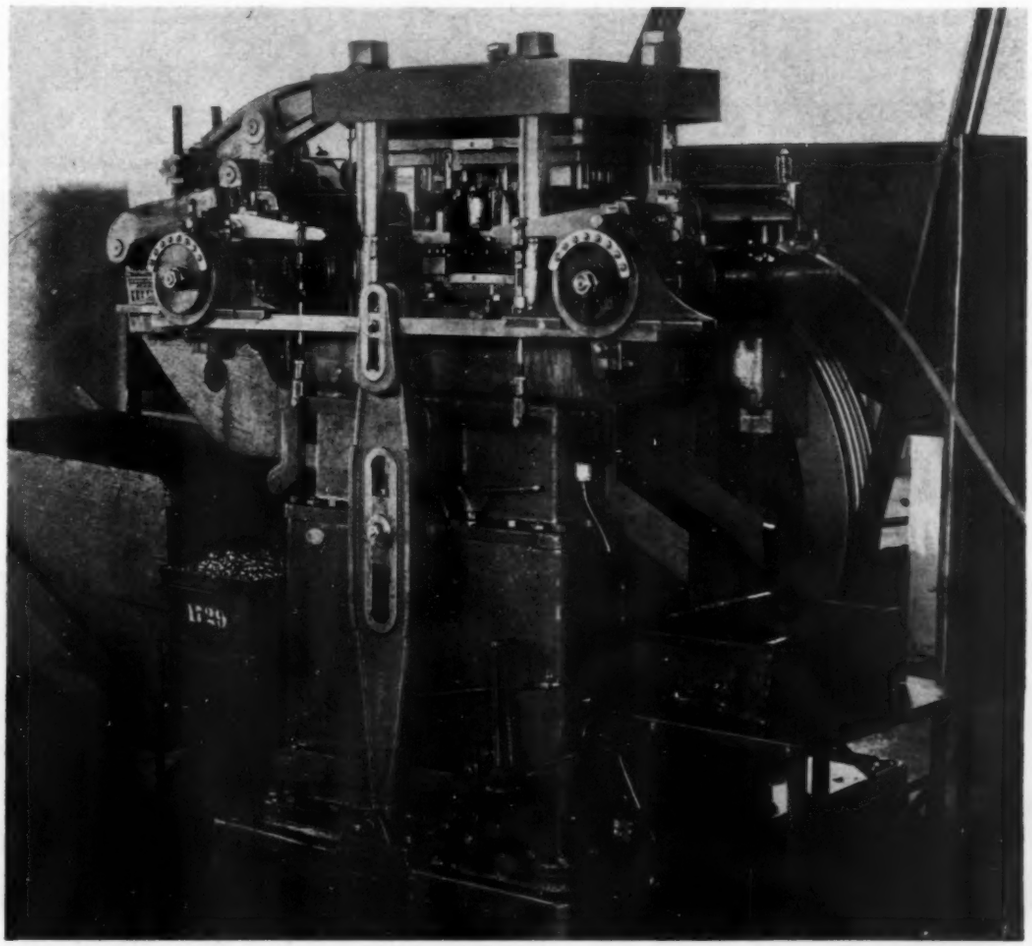
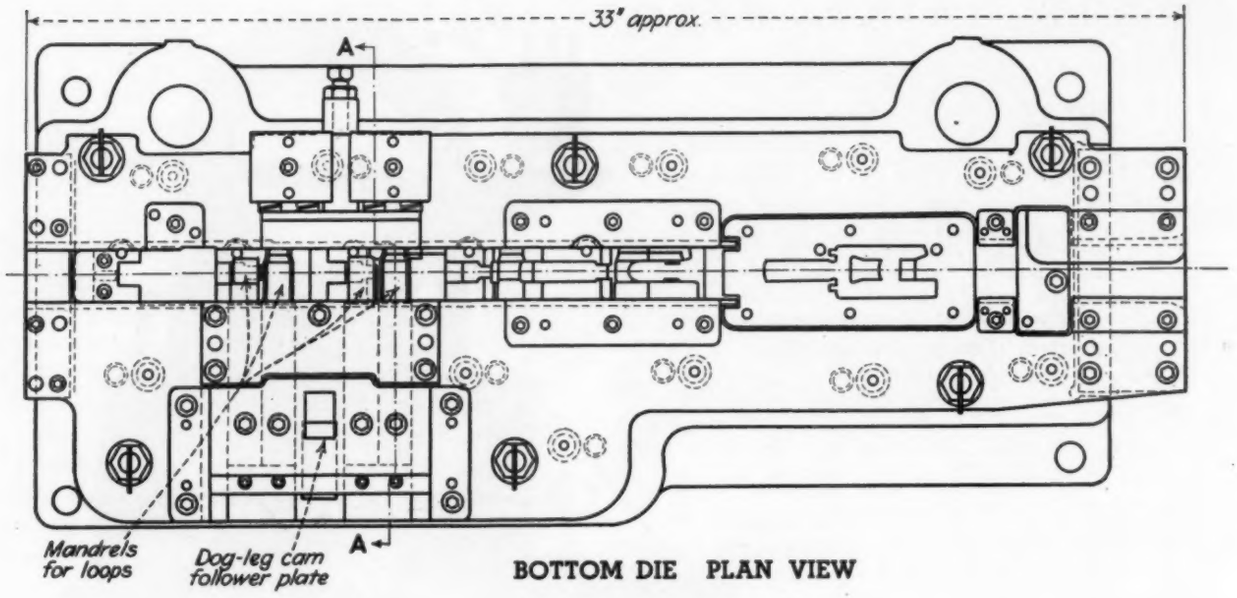
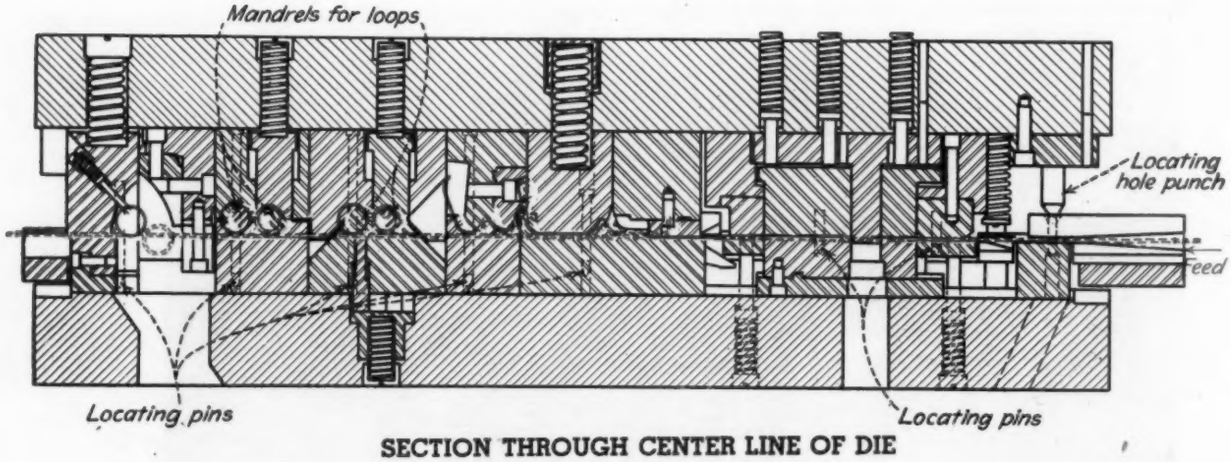


Fig. 5—Henry & Wright 50-ton die machine with 4¼-in. stroke for 30-caliber links. A Henry & Wright Special (approximately 60-ton machine with 5-in. stroke) is used for 50-caliber links. Note roller stock feed



BOTTOM DIE PLAN VIEW



SECTION THROUGH CENTER LINE OF DIE

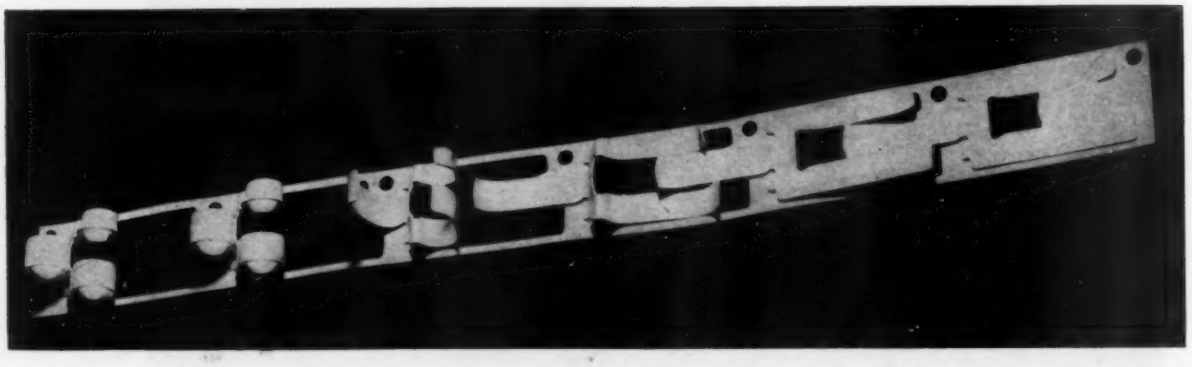


Fig. 7—Links are formed completely in this eight-station progressive die, beginning with a locating punch in the first station, as indicated in the sectional view above. Loops are formed over mandrels moved into place by a dog-leg cam, as indicated in the plan view, top. Links are separated from the strip stock at the last station

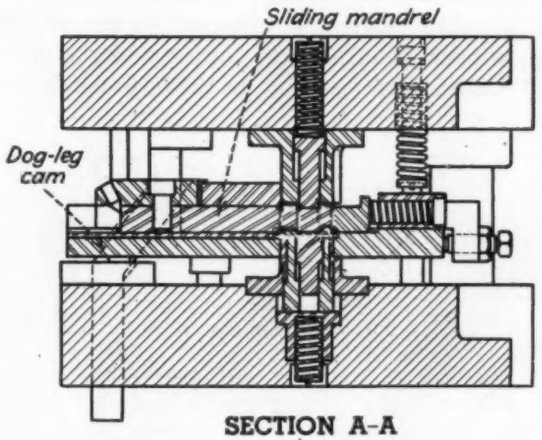
feed into the reciprocating chute the links are placed in the hopper (Fig. 10) and charging machine after being removed from the degreaser.

The links are heated to about 1,500 F., after which they drop onto a belt conveyor in the quench tank. This conveyor lifts the links and carries them into a washing machine for cleaning. They are rinsed by jets of hot water from a drilled pipe placed across the top of the conveyor belt.

After drawing in an electric batch-type furnace at 530 F. for 30-caliber links, slightly higher for 50-caliber links, the links are sand-blasted. This operation not only removes scale but also knocks off any burrs left by the blanking operations. A fine steel grit operating under a pressure of 60 lb. per sq. in. is used for sand-blasting. Links are zinc plated after this operation.

Procedure in the plating room is as follows:

1. Wash thoroughly in alkali bath containing no resin.
2. Rinse in clear boiling water.
3. Pickle a minimum of one minute in a solution of 50 percent muriatic acid and 50 percent cold water. This acid pickle must be kept up to strength. Longer pickling will not necessarily harm the links.
4. Rinse in cold water.
5. Place in barrel plating machine and plate for a minimum of 30 min. for 30-caliber links and 50 min. for 50-caliber links at an operating temperature of 97 to 103 F. A constant current flow must be maintained; 12 volts on the barrel with 255 amp. through the links themselves is required for satisfactory work. The production load is 35 lb. per barrel of 50-caliber links and 30 lb. per barrel of 30-caliber links. The plating solution now used contains the following quantities of ingredients per gallon of water: caustic soda (NaOH), 10 oz.; sodium cyanide (NaCN), 8 oz.; zinc cyanide ($Zn(CN)_2$), 8 oz.; and hypo ($Na_2S_2O_35H_2O$), 2 oz. About 700 ± 40 gallons of water is used in the six-barrel plating machine. Production is about 125,000 links per 8-hr. day of the



SECTION A-A

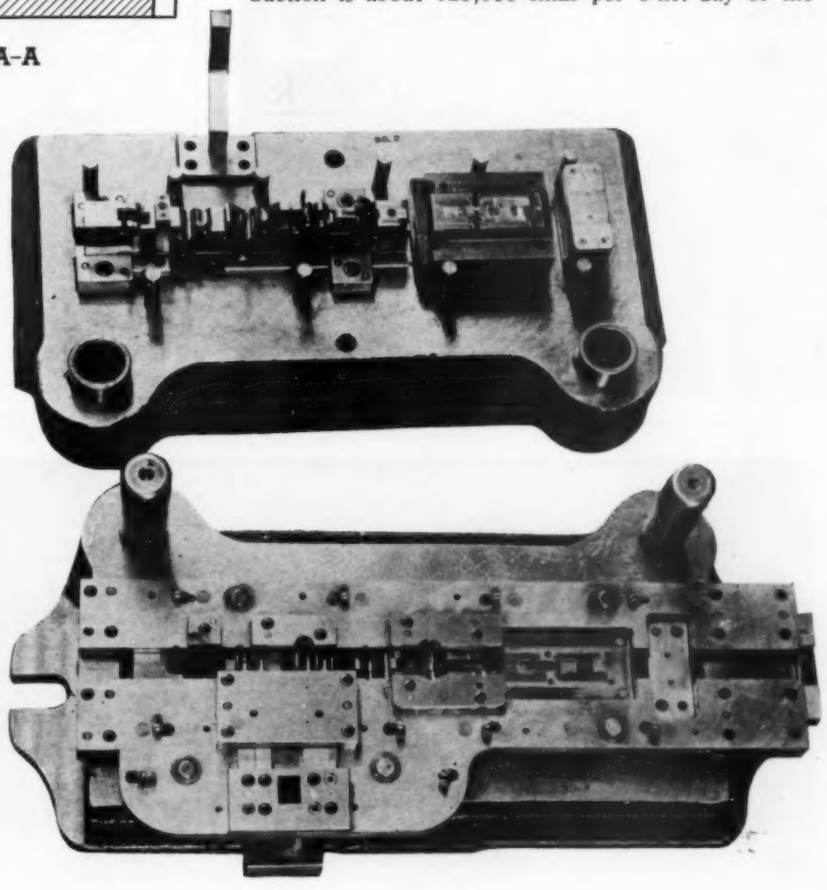


Fig. 8—The illustration at right and sectional view above indicate the working of the dog-leg cam for operating the loop-forming mandrels. These mandrels are pushed completely home before the loops are wrapped around them

30-caliber size and about 25,000 links per 8-hr. day of the 50-caliber size.

6. Cold rinse, hot rinse, and dry in a centrifugal type drier.

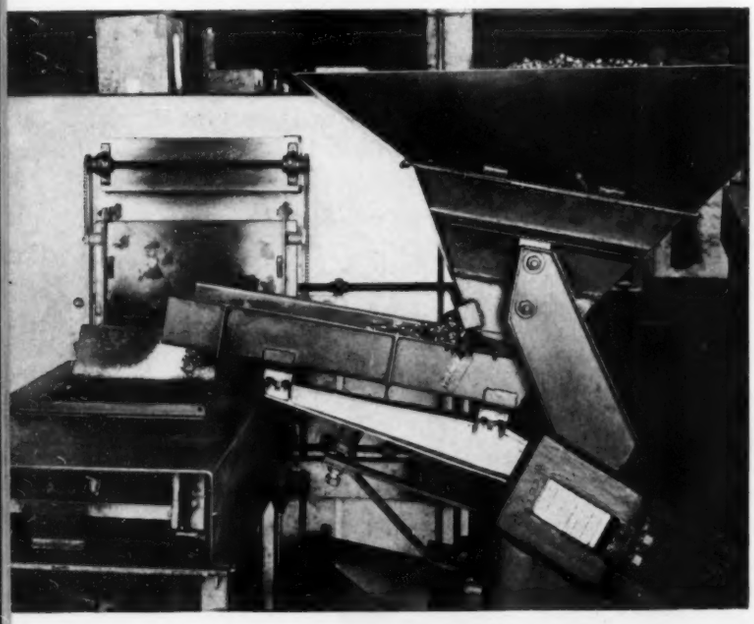
Three links from each barrel are removed for a strip test and salt spray test. The solution for the stripping test is: ammonium nitrate, 100 grams; concentrated nitric acid, 55 cc.; distilled water to make 1,000 cc. total. A flask with petcock arranged to give 2 drops per sec. is suspended over the inspection table. The plating must withstand 18 sec. application of the solution. This is considered equivalent to more than 48 hr. in a salt spray test for which the remaining one of the three random selected samples is used.

The links are finally baked in an electric furnace at a temperature of 450 F. for 3 hr. to eliminate embrittlement due to hydrogen. After baking the links are ready to go to final inspection and shipping. Each link is tested for accuracy of the inside diameter of the loops and for strength.

Each 30-caliber link must withstand a pull of 50 lb. and each 50-caliber link a pull of 100 lb. The machine on which this test is made is shown in Fig. 12. Links are slipped over two mandrels, one of which is stationary. The other mandrel is on a lever at the other end of which is a spring-supported weight. If the link is too weak it will stretch sufficiently for electrical contacts to close and cause a light to warn the inspector that it should be rejected. If the link is too brittle the load will cause it to break. If the loops are not of proper diameter they will not fit over the mandrels.

A 16-in. belt for 50-caliber links or a 12-in. belt for 30-caliber links must withstand a twist of 180 deg. without failure or permanent set of the links.

To insure proper grip on the cartridge the fixture



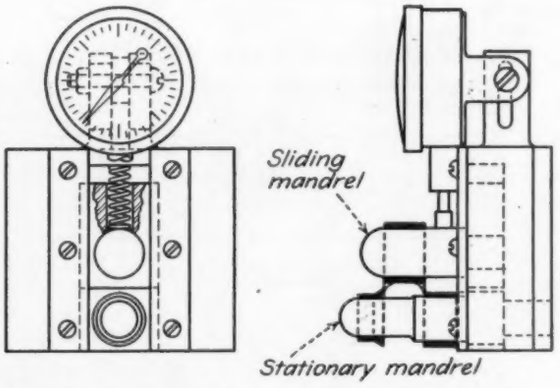


Fig. 9—After pressing, center distances of loops are checked on random links with this gage

Fig. 10—A rheostat controlled magnetic type vibrating feeder drops links onto a shaker, which feeds them onto the furnace endless belt in proper amounts. Feed was improved by lining the feeder chute with rubber

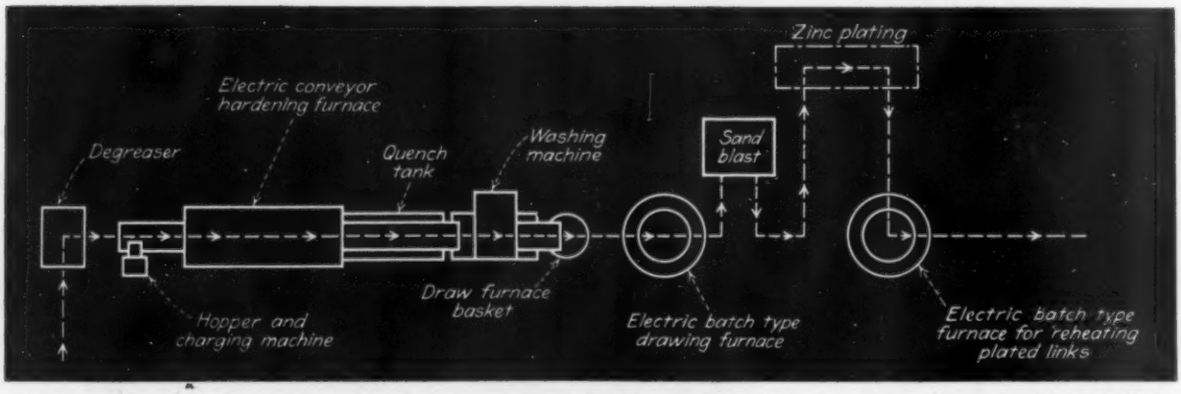
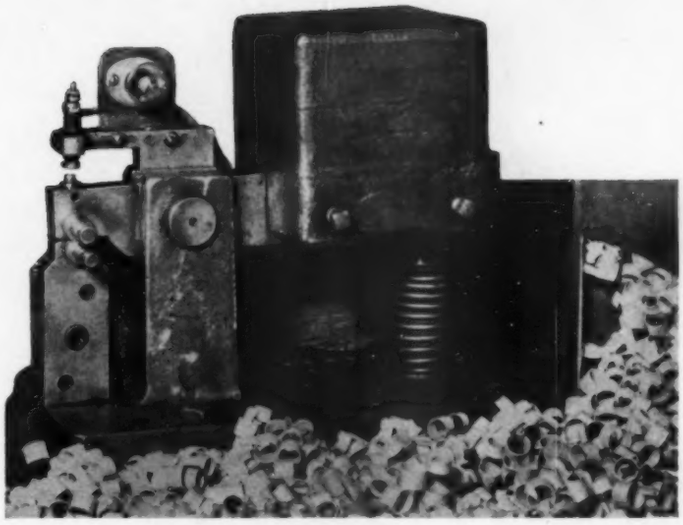


Fig. 11—Heat-treating and plating arrangement used at Rock Island Arsenal in making metallic belt links

shown in Fig. 13 is used to measure the pull required to extract a steel mandrel of the same size as the shell from the link. Pull should be 5–10 lb. for the 30-caliber size and 15–30 lb. for the 50-caliber cartridge.

After the link has successfully passed the pull test it is put through inspection gages at the head end of the loading chute. There are three gages, Fig. 14, which automatically check the over-all width of the double loop, the over-all width of the single loop, and the space between the loops. The end of the chute is arranged, Fig. 15, so that the proper number of links can be moved into paper cartons.

The paper cartons in which the links are packed have an open side which makes them difficult to break with any hand-operated mandrel. For that reason a paper break machine, Fig. 16, has been designed and is in use at the arsenal. The cartons are then slipped into the space provided for them at the end of the



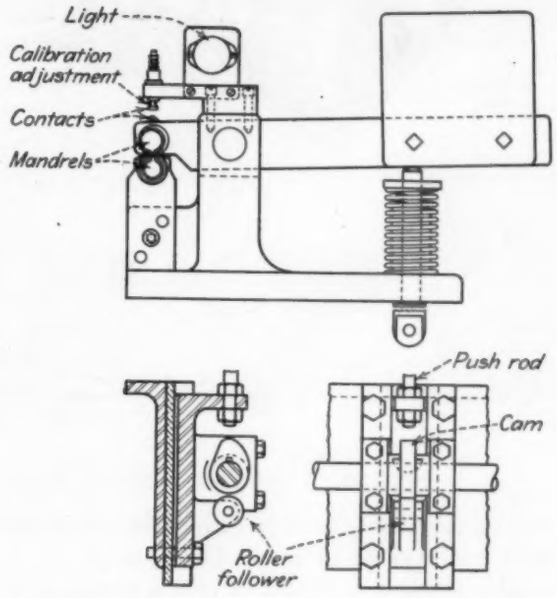


Fig. 12—Every link must pass a pull test in this fixture, which indicates a weak link when the electric bulb lights. The weight is operated 52 times per min. by a rotating cam

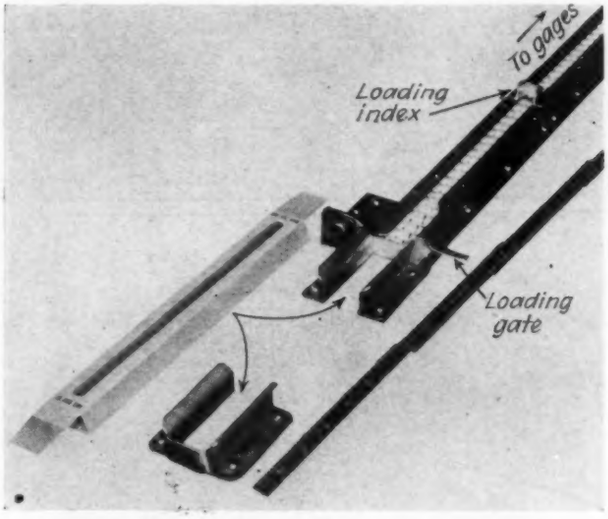


Fig. 15—Loading chute fastened to metal-top inspection table has a fixture at the end for holding a paper carton while links are pushed into the carton by hand

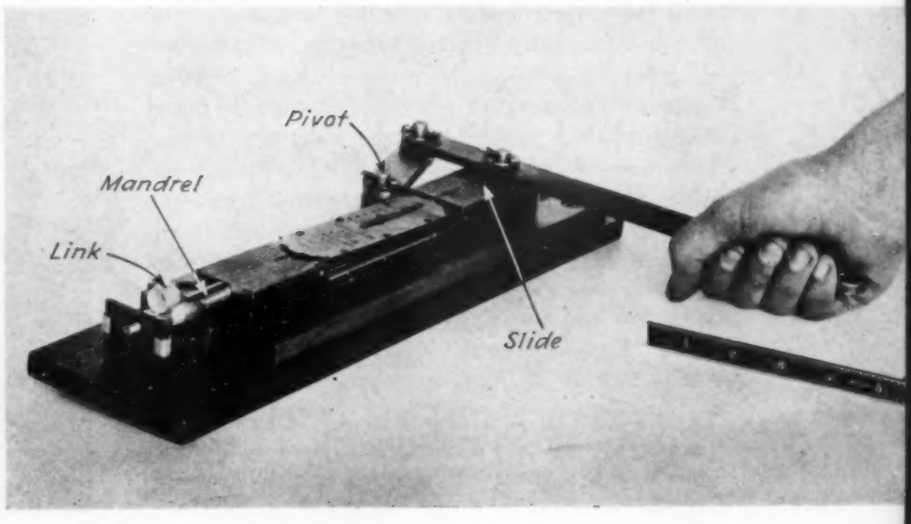


Fig. 13—After heat-treatment, some of the links from each batch are given an extraction test. The spring scale between the mandrel and lever must register a 5–10-lb. pull on 30-caliber links (15–30-lb. on 50-caliber links) for them to be acceptable

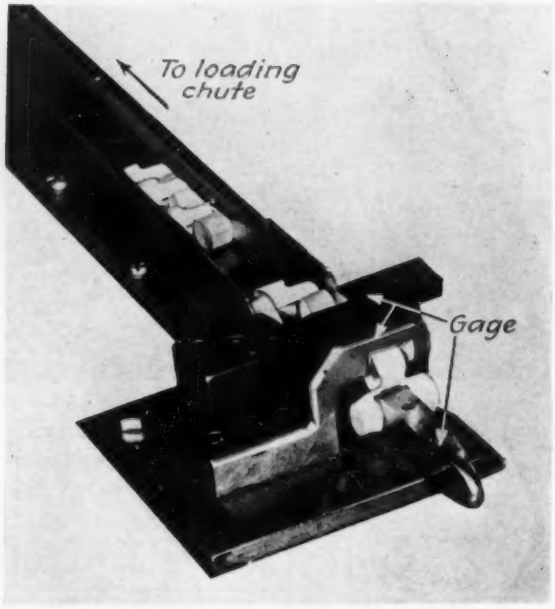
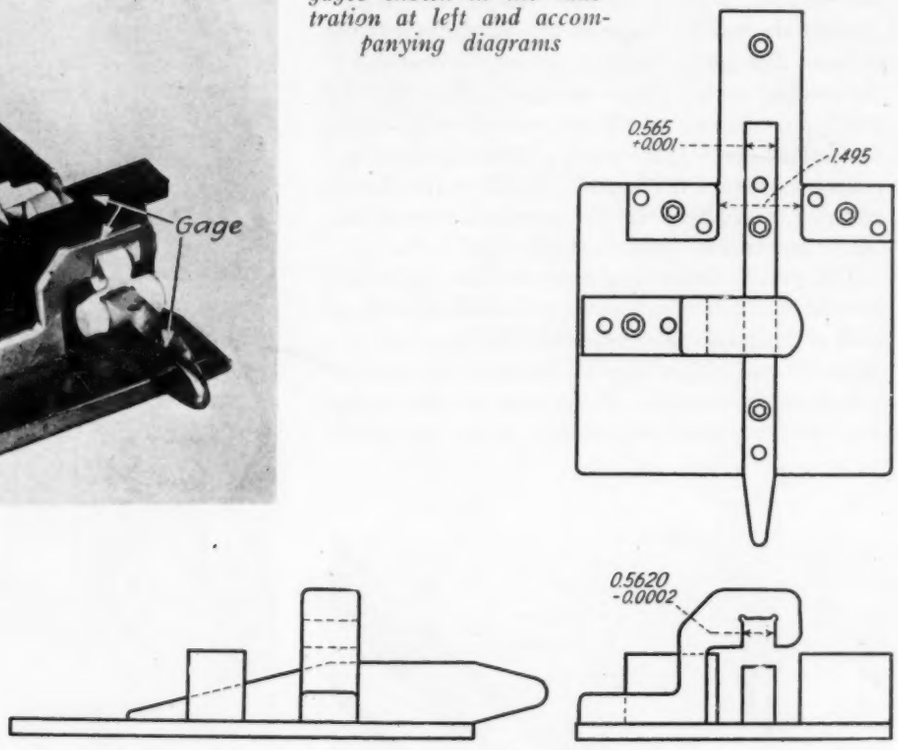


Fig. 14—After the pull test, links must pass through the dimensional inspection gages shown in the illustration at left and accompanying diagrams



loading chute and the links moved down by a small hand bracket as shown in the photograph.

This article is presented to give a picture of the problems involved in the manufacture of metallic links for cartridge belts and the solution as developed at the Rock Island Arsenal. However, statements in it are not to be construed as officially reflecting the attitude of the War Department.

In the present rapidly changing situation where outside contractors are beginning to manufacture these items it is inevitable that some changes will be made in procedure. For example, a die is being designed which will reduce the amount of scrap. Heat-treating procedures are being contemplated which will eliminate degreasing and washing operations by using a controlled-atmosphere furnace and gas-fired draw furnaces. Materials handling methods are subject to change. These will be reported upon as the art progresses.

Fig 16—In this paper break device, flattened cartons are slipped over a spring steel blade and forced against a foot-operated plate, thereby opening the cartons to box form

FLUSH RIVETS FOR SPEEDY AIRPLANES

Bell Aircraft Corporation has developed a flush-riveting technique that includes making rivets, countersinks, dimples and finished joints to tolerances of ±0.002. The resulting plane surfaces are reflected in the speed of the Bell Airacobra

By ARTHUR A. SCHWARTZ
Tool Design Engineer, Bell Aircraft Corporation

IN A SURVEY made in the aircraft industry during the early part of 1939, considerable diversity of method in flush riveting was found. Rivets used varied from the so-called "morning glory" types to those with included head angles from 78 to 126 deg. While some concerns drilled, burred, dimpled and countersunk, all on the same hole, others merely drilled the hole and forced the rivet to make its own dimple.

The Bell Aircraft Corporation decided that a thorough study was in order before considering the adoption of any of the existing methods. This article gives the results of that study, and the experiments made in connection with it.

The main objective of flush riveting on the outside surface of airplanes is to reduce air resistance. Obviously, the more nearly the head of the rivet becomes part of a true, flat surface, the better the objective is achieved. An incidental advantage of flush riveting is the saving of weight, which amounts to the full weight of the rivet head when countersinking is used, and about 50 per cent of the rivet-head weight when dimpling is employed. This is illustrated in Figs. 1, 2, 3 and 4.

The strength of the riveted joint is, of course, the major consideration. Experiments indicated that good flush riveting results in a stronger joint than any other form because of the increased bearing area of the head, and the better forging and expansion of the shorter stem. Exhaustive experiments showed a decided superiority of an included rivet-head angle in the neighborhood of 120 deg. Another manufacturer

working along the same lines adopted an angle of 115 deg.

The obvious objections that flush rivets, having such flat head angles, are weak in tension (i.e., in shear of head to shank), must be qualified by the fact that numerous tests proved the sheet the first to fail, and that the subsequent sheet distortion was the cause of the rivet head shearing out of the rivet shank. All this resulted in the conclusion that the rivet was satisfactory in this respect, and more attention should be devoted to the dimpling.

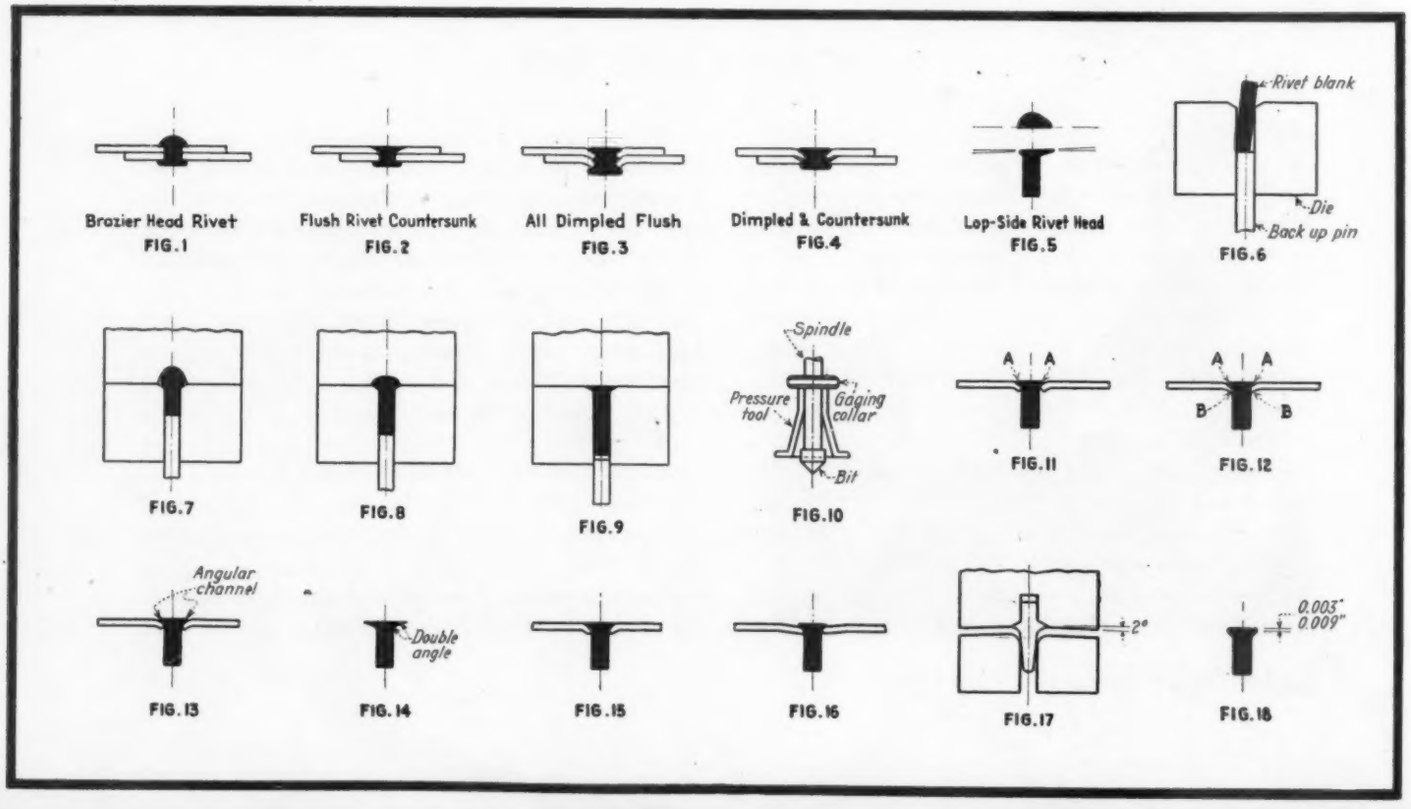
At the outset of this study, it was found that there were no definite standards for rivet tolerances, and no practical means of measuring them was available. Head sizes were checked simply by measurement across the flat of the head. Sizes of countersinks and dimples were checked by taking a number of rivets, inserting them, and feeling with the fingers or a straight-edge to determine whether or not the surface was reasonably smooth. The lack of standards for rivets gave individuality to each size, so that the proportions of head diameter to stem diameter and depth of head to diameter varied in the sizes used.

Therefore, the first step in developing a flush-riveting technique that would give a true flat surface on plane parts was the establishment of standard rivet dimensions. These are given in the table. The proportions of one part of a rivet to any other part, except length, remain constant throughout all sizes. Tolerances were so drawn as to be within those expected on the finished head height, ± 0.002 in. above or below the level of the sheet surface.

Next, standard gage blocks were made to check the head height and angle of the rivet heads. It was decided to make the head height, (a measurable dimension) the criterion, rather than the head diameter, since the head height ultimately determines the height of the rivet above or below the sheet surface. Obviously it is impossible, mechanically, to measure accurately a dimension which extends from one theoretical sharp edge to another, as would be the case in measuring head diameter.

In the making of these gages, the problem of measuring the depth of a countersink or dimple came up for solution and it was decided to use the depth which a known size ball would drop into the gage block, as a true measurement. This ball was to contact the conical depression at a point roughly half way between the upper edge of the depression and the hole for the stem, so that any slight error in angle would not unduly affect the accuracy of the measurement. The depth that the ball extended into this depression was called the "ball drop" of the rivet, and these figures were added to the standards sheets. To facilitate the making of this measurement, a gage was devised (U. S. Patent No. 2,212,306), consisting of a ball loosely held against a slidable member, and an indicator operated by that member, all in a

In developing the riveting technique described in this article, all existing methods were studied. These figures show the existing types of flush-riveted sheets, methods of forming the rivets, and effects of dimpling and driven rivets on the formed joint



Bell based its flush-riveting technique on rivet head height rather than head diameter since the height of the rivet above or below the sheet depends on the former dimension. These gage blocks are used to check rivet head heights to a tolerance of +0.001 in., —0.000 in.

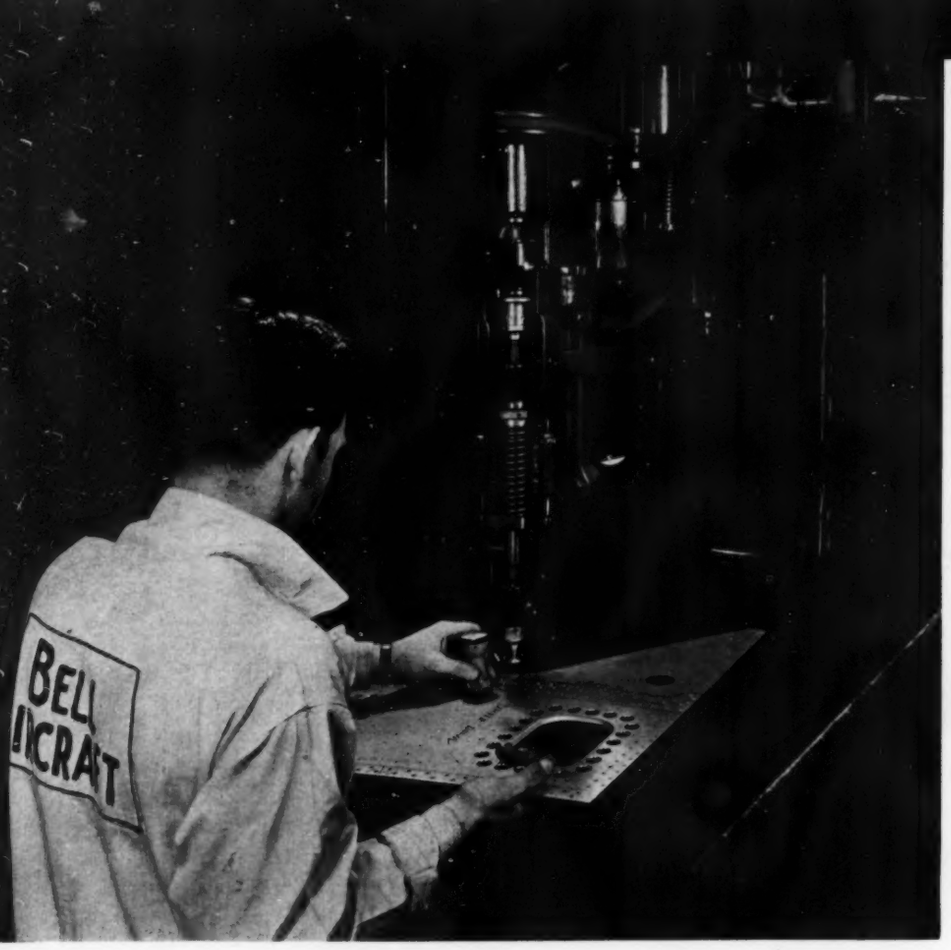
suitable frame. The correct size ball is put into the gage, then, on a flat surface, the indicator is set to zero, it will then indicate the ball drop, when the ball enters the depression. Later, this gage was made in a revised and more convenient design for use in routine inspection of countersinks and dimples; also, for checking the finished (driven) rivet for position with reference to the sheet surface. The use of the gages speeded up testing time, as only one test is required, and a definite result is read in thousandths of an inch, which, in turn, speeds up the adjustment of riveting machines and tools.

With this equipment, it was discovered that it was impossible to make or buy rivets that would measure up to the high standards obviously necessary to produce the finished specifications required by Army and Navy inspection. Rivets of our own make, as well as those purchased from outside sources, varied by as much as 0.008 in. in head heights, and the contour of the head was usually lopsided as illustrated in Fig. 5. It was found that the only dimension easily kept on existing rivet machines was the over-all length. Heads varied according to the length of the blank, the contour of the cut, and the position of the blank in the die prior to heading; the latter is shown, exaggerated, in Fig. 6.

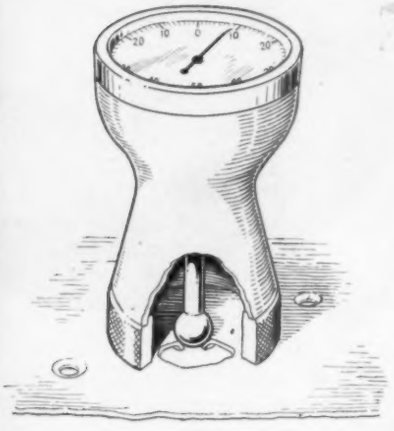
A new kind of die was made introducing two more phases in the making of a rivet. One of these phases, the "centering", is illustrated in Fig. 7. Here, the material required for a head is gathered in a spherical lump and centered over the die by virtue of the shape of the punch. The second added phase is shown in Fig. 8. This carries the centering a little further and provides a shoulder to back up the head in the final operation. The backup pin is dropped in the final operation, so any excess material in the head will be forced down into the stem, rather than permit the formation of flash on the side of the head, as shown in Fig. 9. In these rivets all tolerances can be held extremely close, except the over-all length. This, of course, can be controlled within satisfactory limits by accurately gaging the length of wire initially introduced into the die.

The above method of manufacturing rivets is much easier, both on the tools and the machine, than were previous methods. Dies last five times as long, and, only a fraction of the power for heading is required. This is due to the fact that at no time is there a condition where the material is entirely confined. In the progression of the rivet through the various die stages, highly important and very interesting properties are introduced into the rivet—the rivet head becomes work-hardened, while the compression on the head, in the final operations, creates a flow of the grain structure into the shank, thus producing unusual toughness in this area. In addition, the backup pin has been released in the final dies which eliminates hardening of the rivet end, thereby making it ideal for driving with maximum accuracy and a minimum of back pressure.

Dimpling and countersinking were then studied. Here, again, new methods had to be devised, as the main concern was with the measurement from the top surface of the sheet. The pressure foot shown in Fig. 10, was devised to hold down the sheet for countersinking, the upper end of the foot being used to gage the depth of the cut. This worked well except for chattering which developed in the countersink bit. A new bit was designed which featured a draw cut, introduced by means of two sickle-shaped cutting edges. These cutters were made of carbon-steel drill rod. Tangs and contours were turned in screw machines, tempered, and finally, by means of a grinding rig, flutes were cut in and sharpened. These cutters have performed remarkably well. One hundred thousand holes per grind is considered usual performance, and this has been exceeded in some cases. For quick locating, the pilot was transferred from the rotating spindle to the stationary table, and by the use of a suitable spotlight, the position of the pilot was shown on top of the sheet. Going a step further, micro-switches were installed on the anvil so that, when the pilot entered the hole, the weight of the sheet caused the machine to function. A time delay relay assured one or more revolutions of the bit after the gaging collar stopped accurately the downward motion of the countersink, which gives a smooth true



The countersink or dimple for flush rivets is measured by the ball-drop of this gage. When set on a flat surface, the gage is set at zero; hence, when placed over the dimple, the ball will drop to record the depth



countersink. Further tests showed that running these cutters at 900 r.p.m. gave a better finish and more accurate depths could be maintained.

At first glance, nothing seems simpler than putting a dimple into a sheet of metal, yet it has proved to be no simple problem for the best engineering talent in the industry.

Sheet aluminum alloy will stretch about twelve per cent if handled carefully. If it is attempted to use a dimple of less than 115 or 120 deg., the stretch exceeds that limit. A number of methods have been devised to overcome this. One method is to shorten the head of the rivet until the distance from shank to rim along the underside of the head becomes less than twice the thickness of the sheet to be dimpled.

Another way is to make such differences in the angle of the die and the punch used to make the dimple, that a coining or forging action starts from the periphery of the drilled hole before the bend of the sheet at the periphery of the dimple has been completed. In this way the normal stretch limit of twelve per cent is increased by creating a flow of the metal in the opposite direction so that the opposing flows tend to cancel each other to some extent. The result is a substantial reduction in sheet thickness at the inner part of the dimple. This is illustrated in Figs. 11 and 12, where an exaggerated condition is shown. In Fig. 11, the head of the rivet is less than twice the thickness of the sheet. At *A* a noticeable ring of material has been forced up, revealing to casual inspection the appearance of a sharp cornered dimple. In Fig. 12, much more coining is used; at *A* an obvious ridge has been thrown up and at *B* the metal becomes dangerously thin. Since a difference of 12 deg. between the angle of the punch and the angle of the die is frequently used, the metal cracks at the drilled hole and subsequent forging closes the crack so it is invisible to the naked eye. Also, the metal is work-hardened to a great extent. As a result, it is known that entire dimples crack off occasionally when a rivet is driven.

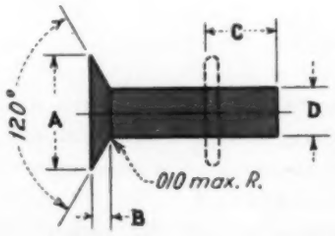
Another method provides polishing the drilled hole to a smooth, round edge which will permit an increase of stretch before cracking. The dies are polished and a special lubricant is used so that the metal can flow from the surrounding area into the dimple. This process has the disadvantage of requiring two extra operations which are rather expensive, that is, burring and polishing. Small radii at the edge of the dimple cannot be obtained, since the large radii are necessary to allow the flow of the metal into the dimple. This increases the area of the annular channel around the driven rivet as shown in Fig. 13. To overcome this condition, the double angle shown in Fig. 14 has sometimes been used on the rivet head. Here, the difficulty of rivet making is increased so much that they are generally turned on a screw machine or on automatic. This increases considerably the cost, and it is very difficult to handle the rivets without damage to the feather edge.

Another method is to let the rivet head form its own dimple. Generally, a rather steep angle is

chosen for this purpose. At first thought this would seem a great saving in the time required to produce the finished job, but such is not the case in actual practice. Driving these rivets requires two operations; one, the dimpling; the other, the upsetting. When dimpling, each rivet must be entered in the female die, and that die must be held square to the sheet surface. When we think of the confined spaces in which these rivets are driven, we can see the difficulties encountered. Theoretically, this should make an excellent job as shown in Fig. 15. The head of the rivet is deformed to make a so-called "morning glory" shape, and so should take up most of the annular channel, commonly formed around the head. In practice, however, it is very difficult due to the hardships encountered in "bucking up" mentioned above. With this method, there seems to be a tendency toward the formation of large, sunken areas around each rivet head, as in Fig. 16, wherein is shown a "secondary dimple." This causes "oil cans" and spoils the smooth contour of the sheet.

Dimpling, in the Bell method, is very simple, due in part to the 115 deg. included angle of the dimpling tools. The allowable stretch of 12 per cent is not exceeded when forming the dimples. Dies and punches are the same angle, thus no coining or metal flow occurs. Holes are simply drilled, no burring or polishing being done. The divergence of 5 deg. between the rivet (120 deg.) and the dimpling tools (115 deg.) was decided upon as a result of many tests. Some of the 5 deg. is taken up in spring-back of the dimple and the remainder, as before mentioned, is useful in making the sheet lay flat on the substructure. The diameter of the rivet head is theoretically larger than the diameter of the dimple, and this results in a very slight forging of the rivet head, thereby taking up most of the annular channel. The slight sliding action of the rivet head when it is forced into a 115 deg. countersink is helpful in fitting the head of the rivet into whatever irregularities may be left by the countersinking bit. The resultant coining helps to keep the usual crescents of unfilled countersinks from becoming aggravating. It must be pointed out that due to the difference in color between the cut surface of the countersink and the dull or painted surface of the sheet, these crescents receive undue attention. They are not nearly so detrimental as the annular channels around a dimpled rivet, though, visually, they are more prominent.

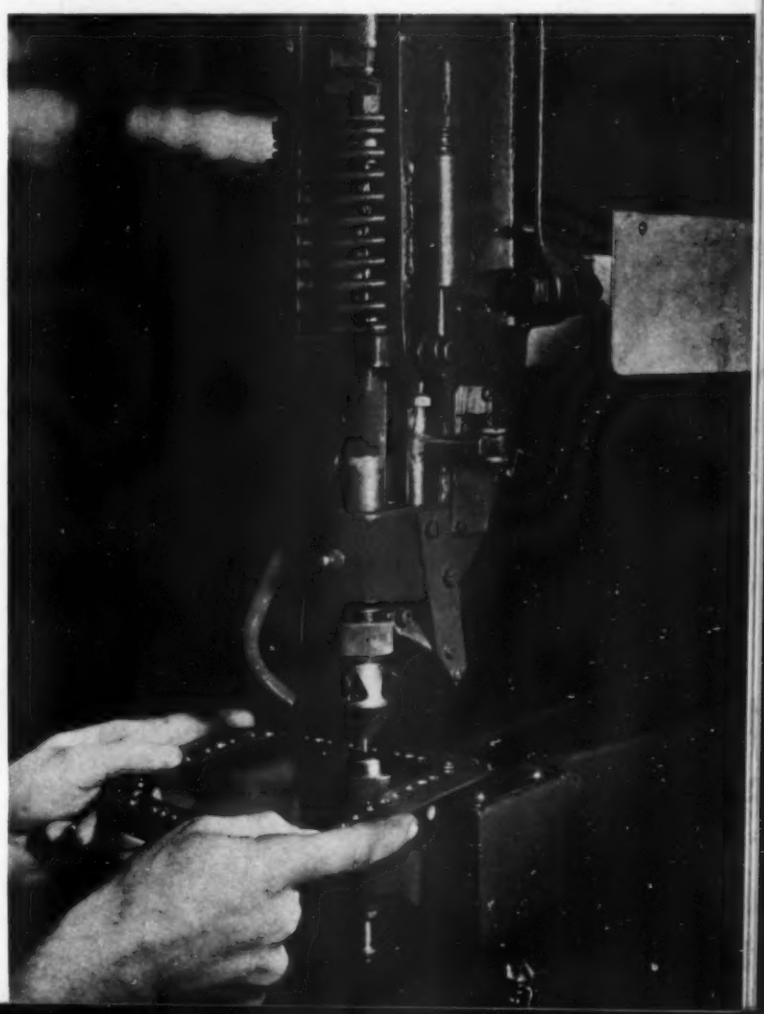
One other precaution against sheet deformation and



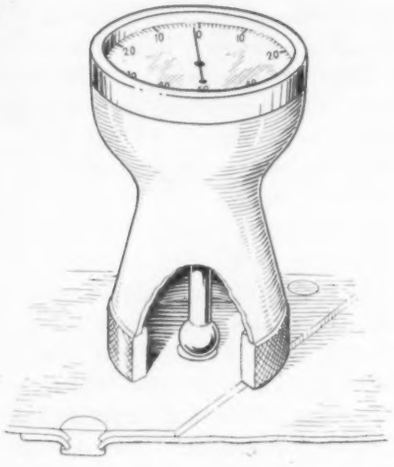
DIMENSIONS OF FLUSH RIVETS

Dimensions, in.			
A	*B*	*C*	*D*
0.125	$0.018^{+0.001}_{-0.000}$	$\frac{3}{32}$	$\frac{1}{16}-0.000^{+0.002}$
0.187	$0.027^{+0.001}_{-0.000}$	$\frac{9}{64}$	$\frac{3}{32}-0.000^{+0.002}$
0.250	$0.036^{+0.001}_{-0.000}$	$\frac{3}{16}$	$\frac{1}{8}-0.0000^{+0.0025}$
0.312	$0.045^{+0.001}_{-0.000}$	$\frac{15}{64}$	$\frac{5}{32}-0.000^{+0.003}$
0.375	$0.054^{-0.001}_{-0.000}$	$\frac{9}{32}$	$\frac{3}{16}-0.000^{+0.003}$
0.500	$0.072^{+0.001}_{-0.000}$	$\frac{3}{8}$	$\frac{1}{4}-0.000^{+0.004}$

Drilled sheets are located for dimpling by a pilot set in the anvil of the machine. A spotlight is used to locate the work quickly. The weight of the sheet on the anvil closes micro-switches and causes the machine to function



The ball-drop gage is used in routine inspection of flush-riveted surfaces. The inspector sets the gage on the rivet head to determine whether or not the head is 0.002 in. above or below the sheet as required by Bell's flush riveting standards



secondary dimples was taken, and that was to provide a reserve angle of two degrees on all dimpling tools, as shown in Fig. 17. This disappears when the rivet is driven, and helps materially in preventing "oil cans" and secondary dimples.

Some flush rivets are made as shown in Fig. 18. Such tolerances are excessive when the finished job calls for 0.002-in. from head surface to sheet surface. This, also, adds much to the annular channel around the head and practically nullifies the main purpose of flush riveting, which is the reduction of skin friction and head resistance.

Summing up, it can be said that Bell method of flush riveting consists of:

1. A set of standards for rivets with an included head angle of 120 deg., tolerances held within the limits dictated by the accuracy of the finished job.
2. A system of rapid and accurate measurements for both heads of rivets and the recesses into which these heads are to fit.
3. A new way of making rivets cheaply, quickly, and accurate to the limits set in the standards with improved strength and driving properties.
4. A semi-automatic countersinking machine which is rapid and accurate.
5. Countersinking bits for making the recesses clean cut and accurate.
6. Making countersink bits cheaply and quickly.
7. A simple, fast dimpling method which does not involve extra operations.
8. Correct angles of countersink dimple and rivet heads for making the job as smooth as possible.

No changes have been made in the manner of driving rivets. Either the squeezer method or the slow hitting hammer is used. Wherever possible, the multiple squeeze should be used, as it helps to keep distortion to a minimum.

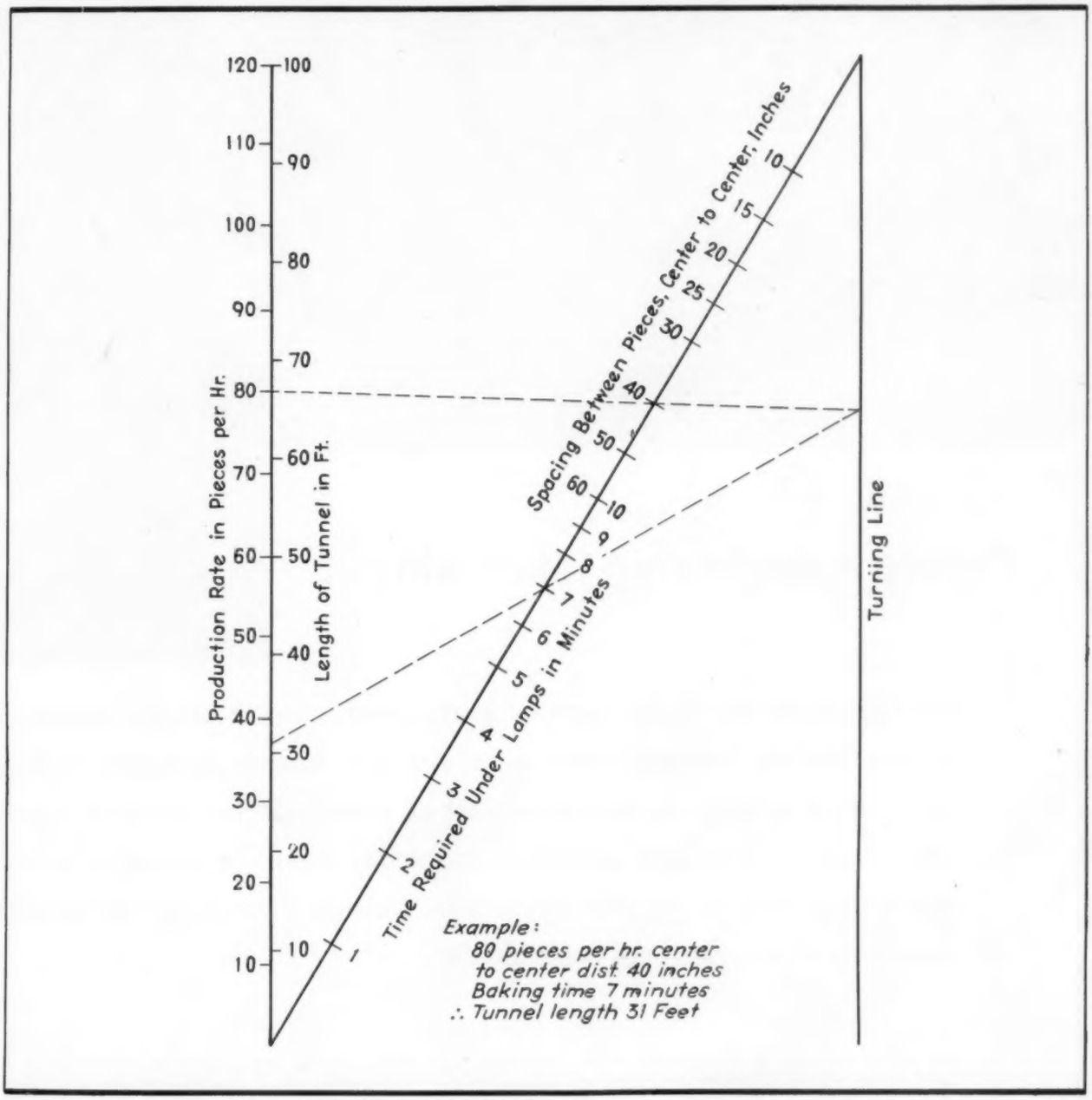
This system was installed originally in the Bell plant on ⅛-in. diameter rivets only, affording opportunities for comparisons with previous methods. Rejections on the ⅛-in. rivets dropped from as high as twelve per cent to less than two per cent.

Infra-Red Baking—I

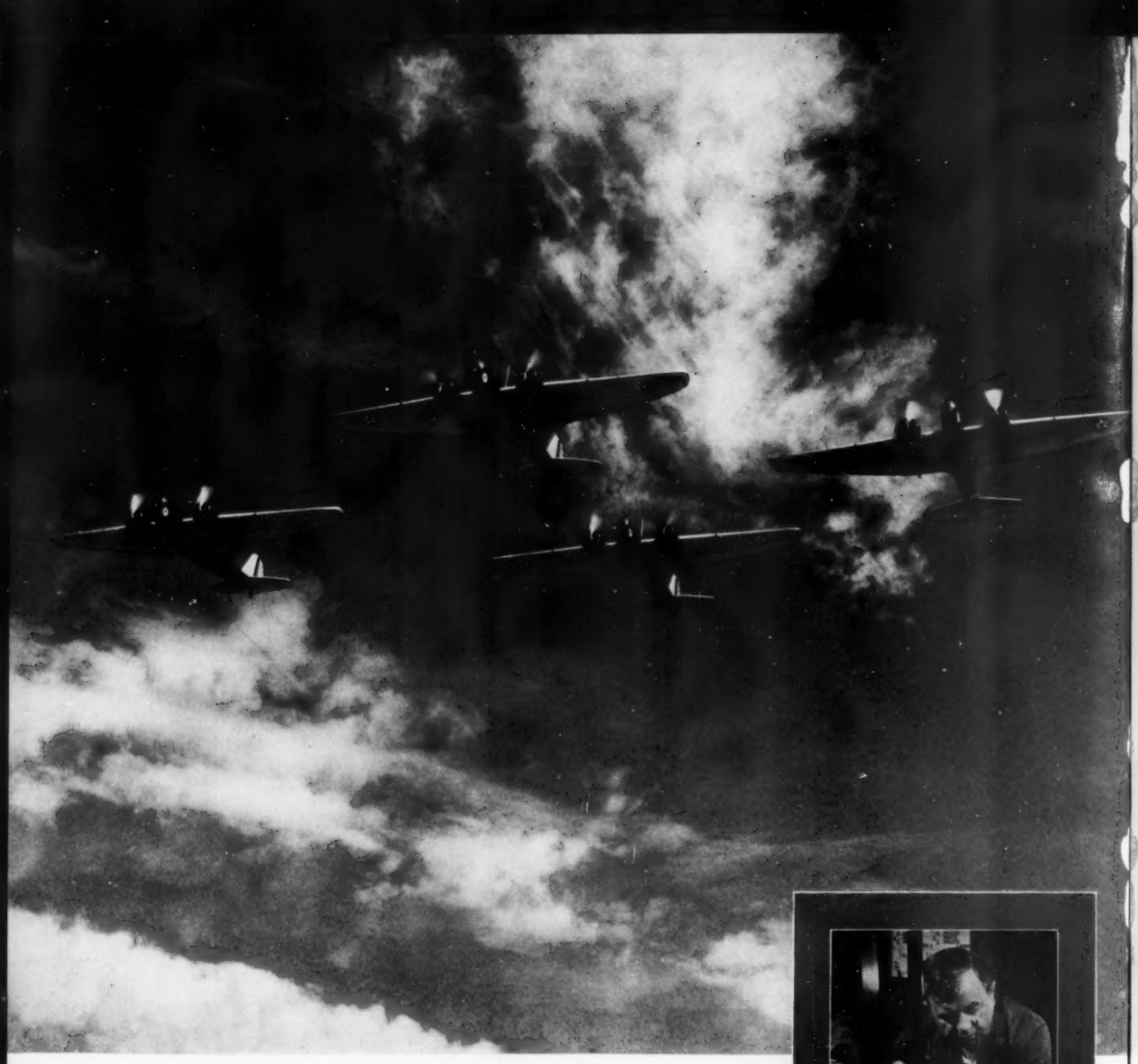
By JOHN SASSO

Tunnel Lengths for Various Baking Cycles

WHEN DRYING FINISHES on parts, using infra-red tunnels through which conveyors run, the determining factors as to tunnel length are production rate in pieces per hour, spacing center to center on conveyor, and time of bake required. The chart below shows the relationship between these factors, and is based on the fundamental formula $L = \frac{P\,d\,t}{720}$, where L is the length of tunnel in feet, P the production rate in pieces per hour placed on the conveyor, d the center to center distance in inches of pieces, and t the time in minutes.



STARRETT TOOLS



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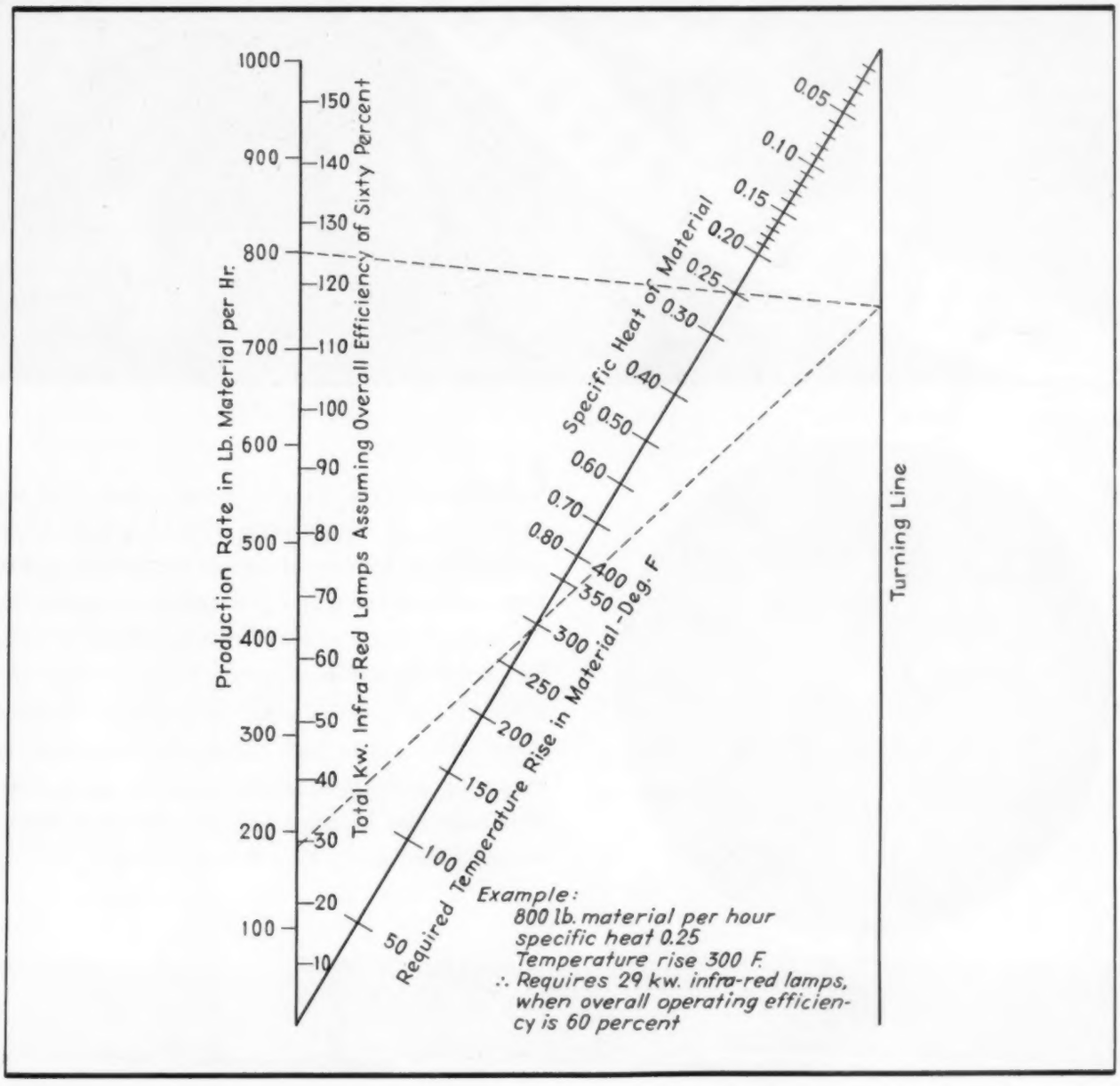
AMERICAN MACHINIST REFERENCE BOOK SHEET

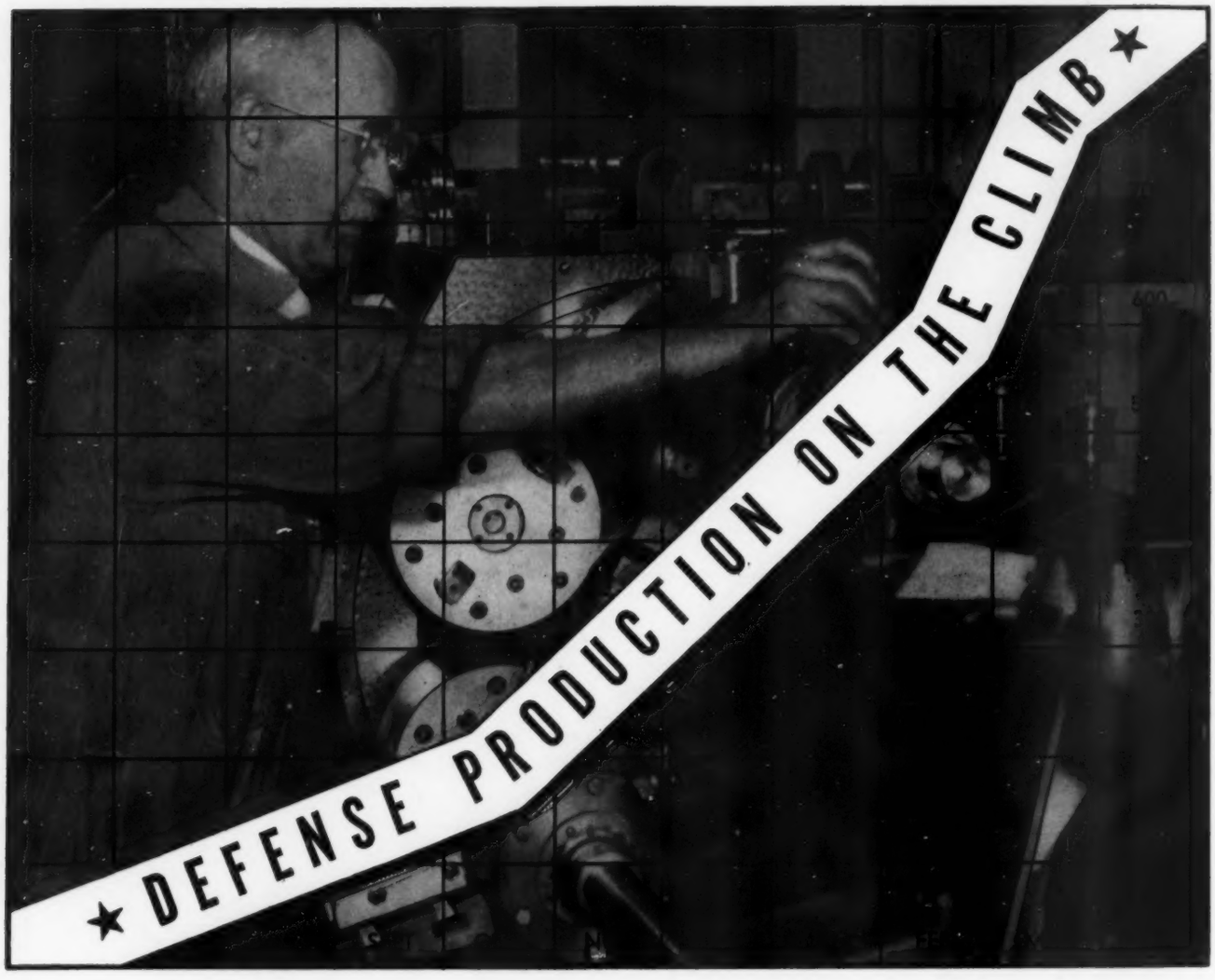
Infra-Red Baking — II

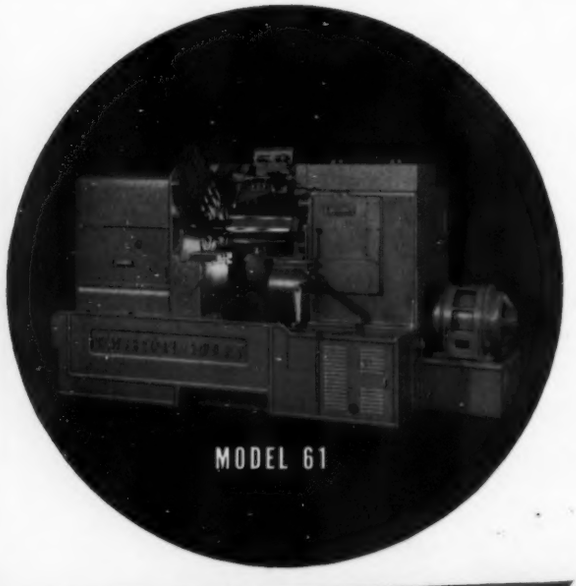
By JOHN SASSO

Kilowatts Required for Mass Heating

INFRA-RED LAMPS are now being used in industry for such applications as heating parts for shrink fits, heating plastic panels before punching, dehydration of graphite powders, preheating of areas to be soldered, preheating chrome-moly tubing before welding, etc. To aid the plant engineer in estimating required kilowatts, the chart below based on the fundamental formula $kw = \frac{M\,s\,(t_1 - t_2)}{0.60 \times 3420}$, has been developed. In this formula M is the amount of material to be processed in pounds per hour, s the specific heat of the material, $(t_1 - t_2)$ temperature differential in degrees Fahrenheit. Having the production rate in pounds of material per hour, and knowing the specific heat of the material, a straight line will give varying relations between temperature differential and required kilowatts. Charts are laid out assuming over-all efficiency of 60 percent.







UPWARD at a dizzying pace speeds Defense Production. Its acceleration can be graphed—its quality can't. To meet strict government specifications while bending the production curve toward the perpendicular requires machine tools at once fast, accurate and dependable. These are the characteristics of New Britain Automatics. Holding close tolerances at high speeds for long periods, they keep Defense Production on the climb. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Conn.

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The Seven-Day Week

IT'S TOO BAD that defense production cannot be doubled by a stroke of the President's pen ordering it. It's also too bad that round-the-clock operation of defense plants seven days a week cannot be accomplished merely by ordering it.

Unfortunately things don't work that way. Factors that you probably hadn't figured on enter into calculations. If pure theory always worked, you could disregard those factors. But reality sometimes is far removed from theory.

To be specific: many machine tool factories are running two long shifts six full days a week. On paper it would seem that going over to three eight-hour shifts seven days a week ought not to be troublesome. Yet four obstacles immediately loom in the path.

One is the great difficulty of finding trained manpower. As one speaker said last week, "The Army can more easily muster 1,200,000 men than the machine tool industry can muster the mechanics it needs." The second is that dislocations brought about by changing from two long shifts to three shorter shifts would sharply reduce output for a considerable time. If you don't believe that, ask any experienced shop man. And the government wants more production quickly, not less.

Third is the lack of foremen and department heads. The most severe shortage in the defense program is in adequate supervisory forces. Already foremen are being spread out dangerously thin.

The fourth—and don't overlook this one—is that men who have been working 60 hours a week, with time-and-a-half figured in, refuse to accept the lower wages resulting from working shorter hours.

There are other reasons which make it hard to go onto a seven-day basis and which tend to reduce plant efficiency. Times are good and pay envelopes are fat. If you don't like the way things are going where you are, you can walk down the street a few blocks and get as good a job or perhaps better. The result is that many men refuse to work on Sundays. They shy away from the night shift. They lay off a day or two when they feel like it, and their jobs wait for them.

All of this stems back to one major point: a substantial number of factory employees are not steamed up about saving Britain or about the necessity for arming ourselves at break-neck speed. They enjoy having a good job and for the first time in years buying some of the things they have long wanted to buy. But they do not believe that this is a national emergency as great as war itself, though that is what defense officials are preaching day and night.

These problems are real to the men charged with the task of enlarging defense production with the utmost speed. They are not insoluble. But they do interpose factors which make it impossible to attain overnight the goal set by the President.

Burnham Finney

GAGING BUSINESS

Biggest machine tool program ever known, totaling $600,000,000, is coming for defense speed up. Airplane industry alone will take $380,000,000 of tools. Small arms program stepped up

Plans are well under way in the metal-working industry to speed up defense production in response to the President's request. The difficulty of securing enough trained men, reluctance of workers to give up long hours with overtime pay, the slowing down of operations while companies go from two long shifts to three shorter shifts and the indifference of employees in many plants to aid for Britain and toward the national emergency are some of the reasons why Mr. Roosevelt's request for round-the-clock activities seven days a week cannot be met immediately.

Machine Tools—The new plan for speeding up defense manufacture and for building bigger munitions and plane capacity in this country will shortly deposit in the laps of machine-tool builders the largest machine-tool program yet conceived. It roughly will require, on top of orders previously placed, some $600,000,000 of machine tools. That is the equivalent of nine months or more full output at the industry's current level. New needs of the aircraft industry under this program will take around $380,000,000 of machine tools, all of which are to be delivered by the middle of 1942. The Government's gun production plants will demand machine tools totaling well over $125,000,000. The load on the industry is expected to be so great that further enlargement of manufacturing capacity is inevitable. By the end of the year it appears likely that the industry will be running at an annual rate of more than $800,000,000. Since the load is not evenly distributed among all members of the industry, some companies with extra capacity will be asked to make machines on contract for other busier companies. Builders suggest that if non-defense plants will run so-called critical machines 24 hours a day, other critical machines of the same type will be released for work on defense manufacture. That would help to accelerate munitions output.

Munitions—Around two billions out of four billion dollars alloted for new munitions productive facilities have been contracted for. One of the biggest undertakings is nine new plants for manufacture of small arms ammunition, some of which should be in operation next fall. Along with the urgent need for machine guns, anti-aircraft guns and small arms ammunition, the British are pushing hard to get medium-size tanks in this country for service in North Africa. An encouraging feature is that machine-gun production is far ahead of schedule. The Vilter Mfg. Co., Milwaukee, completed the past week the first 105-mm. howitzer ever turned out by U. S. private industry.

Farm Equipment—As farm prices improve, presaging income better than last year's, farm equipment sales are running 15 per cent ahead of those in 1940. Exports, however, are off. Shortage of materials is reported a serious problem. International Harvester has war orders, U. S. and foreign, totaling $40,000,000. Pullman-Standard has delivered to the Army the first 81-mm. mortar made in the middle west.

Railroad Equipment—Car builders feel that freight car orders this year may easily reach 100,000 units. They are now producing cars at the fastest rate in 20 years. Large contracts are in the offing, but it is doubtful whether deliveries on any new orders can be made this year because plants are so tied up with defense work as well as with regular business. One large locomotive builder is booked solid until into the first quarter of 1942. The Government has loaned Pullman-Standard over a million dollars to prepare buildings and machinery for manufacture of outer wing assemblies and spare parts for Douglas. Lima Locomotive Works has received a British order for 400 tanks to be made in a new plant addition at Lima, Ohio.

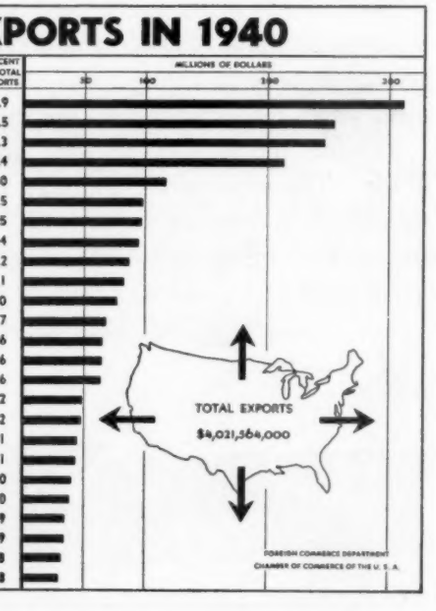
Steel—As the situation gets even tighter, less steel is becoming available for non-defense projects. A considerable tonnage of steel was lost by enforced shutdowns during the coal strike. Now that coal operation has been resumed, the steel rate has shot back up to full capacity. The burden imposed by the "Lend-Lease program on top of an already heavy schedule is likely to bar many non-defense users from getting hardly any steel at all, particularly alloy steel. Rail steel and structural steel will be in big demand the remainder of the year. Shell steel requirements alone are estimated at 4,000,000 tons or more. Deliveries are lengthening on such products as sheet stock. The British soon again will be an important purchaser of U. S. steel.

Aircraft—The airplane building program has been stepped up three times in the last three weeks. Both Wright Aeronautical and Pratt & Whitney will have to increase their engine productive capacity sharply to meet the new bomber-plane schedule. One engine company alone will have to enlarge its manufacturing capacity three million square feet over and above all previous plans. Production is to be started by July 1, 1942. Much of the expanded bomber program has been turned over to the automobile industry, which will be in airplane manufacturing on a still larger scale than heretofore contemplated. Wright will begin producing pilot engines at its Cincinnati plant in June.

Shipbuilding—Repair of British combat ships in U. S. yards has taken priority over all other work. A number of British ships have arrived and more are expected. They are brought in at night under the greatest secrecy. The Bureau of Ordnance of the Navy probably will get an initial allocation of $285,000,000 of Lend-Lease money to give aid to the British Navy. The Navy is now financing the building of five ordnance plants at Louisville, Ky.; Canton, Ohio; Macon, Ga.; Centerline, Mich; and Indianapolis.

OUR CHIEF EXPORTS IN 1940

RANK	COMMODITY	VALUE	PERCENT OF TOTAL EXPORTS
1	AIRCRAFT, PARTS, ETC.	$311,757,000	7.9
2	AUTOMOBILES, PARTS, ETC.	254,308,000	6.5
3	METAL-WORKING MACHINERY	246,516,000	6.3
4	UNMANUFACTURED COTTON	213,662,000	5.4
5	ELECTRICAL MACHINERY, ETC.	116,708,000	3.0
6	STEEL INGOTS, BLOOMS, SLABS, ETC.	98,543,000	2.5
7	IRON AND STEEL PLATES, SHEETS, ETC.	97,609,000	2.5
8	LUBRICATING OIL	94,465,000	2.4
9	COAL AND COKE	87,068,000	2.2
10	REFINED COPPER	81,841,000	2.1
11	AGRICULTURAL MACHINERY	76,879,000	2.0
12	CRUDE PETROLEUM	67,845,000	1.7
13	GASOLINE	64,859,000	1.6
14	IRON AND STEEL BARS AND RODS	64,317,000	1.6
15	FIREARMS AND AMMUNITION	64,164,000	1.6
16	IRON AND STEEL TUBULAR PRODUCTS	48,398,000	1.2
17	IRON AND STEEL SCRAP	47,097,000	1.2
18	TIN PLATE, ETC.	44,375,000	1.1
19	LEAF TOBACCO	43,632,000	1.1
20	MERCHANT VESSELS	40,799,000	1.0
21	COTTON CLOTH	37,910,000	1.0
22	GAS OIL AND FUEL OIL	34,667,000	0.9
23	STRUCTURAL IRON AND STEEL	33,892,000	0.9
24	CONSTRUCTION-CONVEYING MCHY.	31,370,000	0.8
25	WOOD PULP	29,746,000	0.8



Fleets of Bombers To Be Built by the Auto Industry; Production Begins About July 1942

BY ROBERT COLBORN

WASHINGTON—The huge new fleets of bombers with which Roosevelt made headlines this month are to be built by the auto industry. FDR's letter revealed a plan to step up vastly Knudsen's Detroit bomber program of last fall. But the new bombers won't be in production, probably, until about July of 1942. The present Detroit program calls for production, starting late this year, of 100 four-engine bombers and 200 twin-engine bombers a month. The new plan, when it gets rolling, would step up this output by about 250 a month of each type.

For the past year the idea has been kicking around that the auto industry should build aircraft. The first large scale move in that direction came last fall when Knudsen announced his plan to have auto firms build parts and sub-assemblies to be assembled in four midwestern government owned assembly plants. This plan nearly doubled the previously scheduled productive capacity, as of July, '42, for medium and heavy bombers.

Details of the new program are still hazy, but apparently it is intended to take the final step and assign the job of building complete aircraft to Detroit. In part, the present system will be followed, and three or four new government assembly plants are in prospect—to be operated, like the present ones, by plane manufacturers. But at least one or two auto firms will build complete planes. Ford has been anxious to take on this job, and, although the Air Corps discouraged him, he has designed his new parts plant so that it could be adapted to final assembly. And there is talk that General Motors, and perhaps others, may try their hands. Substantial capacity for this job should be released by next year's curtailment of auto output. Although the cut so far announced only brings production to last year's level, this output could be achieved with greatly reduced plant facilities if the intensive multiple-shift type of operation used this year were continued.

Fewer Pursuits, More Bombers

This new increase in bomber scheduling appears to reflect a rough division of function by which this country would concentrate on bombardment aircraft, of which British output is small, while England would concentrate on pursuit, in which a fairly satisfactory production has been achieved.

Until last month, U. S. production has been heavily overweighted on the side of pursuit, which represented about half of the combat planes built. This began to be rectified in April. Plane production that month totalled 1,427, of which something like 1,300 were military types. It is believed that a little under 700 of these were combat aircraft, of which something like 400 were bombers of one sort or another.

Since January, if the bad February figure is disregarded, production of military planes has risen about a hundred a month, which would indicate that the scheduled 1,500 a month output for June will be attained.

Meanwhile, information from industrial sources in England suggests that plane production there is running about 1,600-1,700 a month, presumably with a higher percentage of combat types than here. Well informed British sources estimate German output at about 1,850 a month.

Despite the encouraging showing made by recent production figures, some foreshadowing is seen of a reshuffle among men in charge of the planning and scheduling of aircraft output. This is now the job of a number of special committees of representatives of Army, Navy, British, and OPM's aircraft section headed by Merril C. Meigs; OPM representatives tend to be the most active members of these groups. Recent appointment of Robert A. Lovett as undersecretary of war for air and of General Burns as adviser on air to Lease-Lend Administrator Harry Hopkins are seen by some as a shift toward vesting fuller control of the program in the services.

Curb on Strikes Unlikely; Opposed by Both Sides

WASHINGTON—Support for legislation to curb defense strikes seems to be diminishing. There are two bills: The Vinson bill in the House would establish a 25-day cooling period and freezing of closed shops at status quo. In the Senate, the Ball bill proposes a 10-day notification period to be followed by 30 days for peace efforts. The Vinson bill was reported by the House Naval Affairs Committee (an out-of-order procedure—Vinson was irked about delays on Navy production) and will be debated in mid-May. The Ball bill is being reviewed by Senate Labor Committee as this is written. Odds here are against passage of either. If one of them did pass, the President might veto it.

Both CIO and AFL protest such legislation on the ground that the right to strike is impugned by compulsory arbitration and that labor strategy is weakened unless strikes can be timed. Both Knudsen and Hillman are against it, because they fear retaliatory legislation against management, and they fear that disgruntled labor might produce conditions worse than we have now, which they say are not bad.

Many employers are also opposed to the legislation. They say that under a compulsory strike notification period, unions would simply give notice periodically and stand ready to strike, just in case. And they, like Knudsen and Hillman, are afraid that Congress would follow through with restrictions on employers.

Training Defense Workers—*General Electric Co. teaches young men to run lathes, millers, drills and grinders preliminary to taking their places in the national defense industrial program. At the Schenectady plant (above) a new apprentice is shown the machines on which he will train*

Ways to Increase Machine Tools for Defense Discussed at Meeting of Builders' Association

CLEVELAND—With ways and means of increasing production of machine tools for defense purposes as the theme, the National Machine Tool Builders' Association held one of the most profitable and successful meetings in its history at the Hotel Cleveland May 5 and 6. Following only two days after President Roosevelt's plea to industry to speed up production of defense goods by operating all available machines 24 hours a day seven days a week, the meeting was uncommonly dramatic and serious in tone. Ever present was an earnest desire to find methods of meeting the country's defense needs as promptly and effectively as possible. The two-day sessions, some of which were executive in nature, were ably presided over by Frederick V. Geier, president of the Cincinnati Milling Machine Co. and president of the association.

Over 1,000 machine tools of a wide variety and type are now being delivered to defense plants every day, declared Mr. Geier in his address at the opening session. This means that each day's production is large enough to equip a good-sized defense plant. But defense requirements cannot be met by production of new machines alone. All of the machines installed in American industry, numbering well over a million must be effectively utilized.

Suggests Ways to Increase Output

"Every hour that a critical machine stands idle in a manufacturer's plant represents lost production," said Mr. Geier. He suggested three ways of stepping up output of existing equipment: (1) operating machines more hours per week. The machine tool industry has concentrated on operation of critical machines, and today 98.9 per cent of the men in the industry are employed in plants working two or three shifts; (2) releasing critical machines from non-defense industries. Where a non-defense plant has a number of machines of the same type, some could be released for defense work by putting the remainder on a two- or three-shift basis. The machines released could be employed where they stand by subcontracting, or they might be moved to defense plants; and (3) greater production per machine could be attained, probably as much as 10 per cent, by proper analysis and tooling up of jobs.

Mr. Geier pointed out that last fall, before the program was stepped up, defense requirements for machine tools were put at $386,000,000. Since then the industry has produced that much volume. It set as its goal an increase in production of $300,000,000 in 1941 compared with 1940. During the first quarter of this year output went up month by month to $57,000,000 in March, and the year's goal will be reached.

Subcontracting is on a growing scale, according to Mr. Geier. Today it is equivalent to the production of 10,000 men in the industry. In its own plants the industry has doubled its working force the past year. As fast as men can be trained, they are being used to increase assembly and to build up second and third shifts, particularly in the critical machines which limit production. Approximately 14,000 men are now in training.

Two Jobs to Do

The industry has another job to do in addition to building machine tools, asserted Mr. Geier. That is to help engineer and tool up defense plant production. "In defense plants, for Army, Navy and aircraft production, machine tool engineers are analyzing

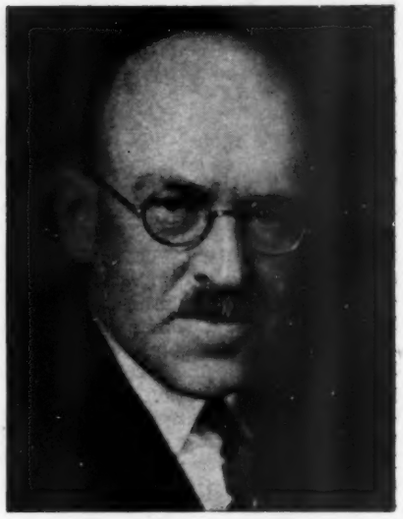
FREDERICK V. GEIER

and laying out methods to secure maximum output per machine and per operator and to secure and safeguard the limits of accuracy that will assure effective operation of weapons and equipment under combat conditions."

Continued Mr. Geier, "Helping to break in untrained operators and inexperienced supervisors is another big job on which the machine tool industry is lending a hand to help get defense production going. Hundreds of experienced machine tool men are on the job in these defense plants every day. One machine tool builder, for example, is building up a trained staff of over 80 men to render this kind of service in the field."

Draft Board Cooperation Urged

In his report as general manager of the association, Tell Berna emphasized that production of every essential element in the defense program can be increased except one—manpower. For



RALPH E. FLANDERS

that reason operation of the selective draft is important to every machine tool builder. The Army can more easily muster 1,200,000 men than the machine tool industry can muster the mechanics it needs. Hence it is essential to increased output of machine tools that the industry's problem be made clear to district draft boards as quickly as possible. Mr. Berna stated that one member has written to each draft board in his city outlining the problem of developing additional skilled manpower and has had excellent results. In case a company has secured deferment for an employee, Mr. Berna outlined the procedure to be followed in asking for a second or subsequent deferment.

Shell Lathes in Production

Mr. Berna said that two companies are equipped to produce shell machines designed by the association. The small sizes for 75-mm. and 105-mm. shell are being built by Kennedy Van Saun Engineering & Mfg. Co., Danville, Pa. This company is making seven machines for its own use in the manufacture of 81-mm. howitzer shell. It will shortly be producing four machines a week. Harris, Seybold, Potter, Cleveland, is making the larger size machine for 155-mm. shell. It has furnished two machines to the Omaha Steel Co., four to Willys-Overland, and two to Colorado Fuel & Iron Co. It has 37 on order. Bids from 30 prospective sources for these machines have just been opened by the Ordnance Department, which plans to order 200 of them.

There is a constant improvement in the attitude of the press toward the industry, said Mr. Berna. The old cry of "bottleneck" no longer is heard.

The feeling of the industry, as expressed unofficially at the meeting, is that practical difficulties prevent operation of plants 24 hours a day seven days a week. Many men refuse to work long hours without rest; therefore it

HOWARD W. DUNBAR

CLAYTON R. BURT

would be hard to recruit a force for Sundays, even with overtime pay assured. Almost all the companies now are on a six-day week. It is the industry's opinion that the men need a vacation this summer after the long hours they have put in during the last year and that any time lost because of a week's stoppage will be more than made up quickly by increased efficiency when employees get back on the job.

Four serious obstacles are in the way of plants on two long shifts going over to three eight-hour shifts seven days a week. One is the difficulty of finding trained manpower. The second is that dislocations brought about for a considerable time during the period of change would sharply reduce the industry's output. A third, and perhaps the most serious obstacle, is the lack of foremen and department heads. The fourth is that men who have been working 60 hours with overtime pay refuse to accept the lower wages resulting from working shorter hours.

Won't Work Long Hours

Machine tool builders agree that one factor working against pushing efficiency in machine tool plants to a still higher level is the indifference of a large percentage of employees to the war emergency. They are not "steamed up" about saving England or, for that matter, about the necessity for arming ourselves at break-neck speed. They resist working night shifts, they like a full week-end off, their bulging pay checks give them the cash with which to lay off now and then, though the management may need them. In other words, to them this is not an emergency as great as war itself.

Mason Britton, Chief, Tools Section, Office of Production Management, outlined to the members the constantly growing national defense requirements and their effect on the machine tool industry. He predicted that the industry would be kept occupied at a rate of $750,000,000 or better a year until at least the end of 1942. Howard W. Dunbar, Technical Chief, Tool Section, OPM, told about the procedure by which his office keeps track of defense needs for machine tools and of the industry's performance on deliveries. Ralph E. Flanders, president Jones & Lamson Machine Co., and former administrator of the Machine Tool Priorities Committee of OPM, cleared up many questions about priority procedure.

Clayton R. Burt, president Pratt & Whitney and chairman of the Defense Committee, and Charles J. Stilwell, president Warner & Swasey Co., led at an executive session a discussion of the defense situation confronting the industry. Wendell E. Whipp, president, Monarch Machine Tool Co. and chairman of the Committee on Color Standard, made a progress report. Members were asked to cast their ballots for a new standard color to be used on machine tools. Both Caterpillar Tractor and General Motors have established their own color standards for plant equipment. Mr. Berna read a report of the Committee on Electrical Problems bearing on new wiring standards. A special session on depreciation reserves was held after the close of the regular convention program. As usual, a number of group meetings were staged in addition to the main sessions.

Sikorsky Breaks Record In Helicopter Flight

BRIDGEPORT, CONN.—Igor I. Sikorsky, famous designer and builder of planes and engineering manager, Vought-Sikorsky Aircraft, set a new world's record last week for sustained flight in a helicopter of one hour 32 minutes and 30 seconds. The helicopter, a wingless craft that rises and descends vertically by "windmill" blades mounted atop its fuselage, was Mr. Sikorsky's own design and construction. The previous record, set in Germany in 1937 by a Focke-Wulf helicopter, was one hour 20 minutes and 49 seconds.

The evening previous to his record breaking flight, Mr. Sikorsky was principal speaker at the Aeronautical Meeting of the Hartford, Conn., Chapter of the American Society of Tool Engineers, where he discussed the possibilities of direct lift aircraft. He indicated that the fixed wing type of aircraft will undoubtedly continue to be of major importance where load-carrying capacity is necessary, but that the direct lift type will eventually find wide application. He indicated his belief that the present speed of 468 m.p.h. is very close to the maximum with the present types of power equipment; he also indicated that a maximum ceiling of 75,000 to 90,000 ft. is all that can be expected with present types of engines and planes. He sees no reason why planes cannot be built to carry 500 to 1,000 passengers.

Machine Tool Makers Asked Not to Increase Prices

WASHINGTON—Machine tool manufacturers and dealers have been asked by Leon Henderson, federal price administrator, not to increase their prices beyond the current level. In a letter to the industry he also requested that "there be no alteration in your cash discounts, trade discounts, volume discounts, carry allowances, methods of quoting prices, credit practices or other trade or price policies which would have the effect of increasing net manufacturers' prices of individual items."

Mr. Henderson said that he is aware that certain cost elements have advanced. "But with assured prices of an important raw material (steel), a favorable demand in the industry generally and decreasing selling and operating costs, I feel justified in making this request of you." After mentioning the crucial importance of the machine tool industry to defense, he said that "in such industries, it is imperative that prices are stabilized, and spirals are avoided. I am asking your voluntary cooperation in the hope, which I am sure we both share, that other steps may be avoided in this industry."

In connection with used machine tool prices, Mr. Henderson amended his original order to limit the prices to various percentages of the new equipment prices as of March 1, 1941.

CHAPIN DIES AT MEETING

DETROIT—Cornelius K. Chapin, 64, president, Murchey Machine & Tool Co., Detroit, died in Cleveland May 6 while attending the Spring Meeting of the National Machine Tool Builders Association. In 1912, Mr. Chapin entered into partnership with Walter H. Jennings in founding the Murchey Machine & Tool Company.

Seriousness of Present Defense Situation Emphasized at National Metal Trades Meeting

CHICAGO—The seriousness of the present defense situation was emphasized by Dr. S. S. Stratton, assistant director of minerals and metals, Executive Priorities Division, Office of Production Management, in a talk at the 43rd annual convention of the National Metal Trades Association held here May 8–9. Continuing with a plea for cooperation and understanding on the part of manufacturers, Dr. Stratton predicted a continued and possibly more drastic change in priorities. The new bomber program and the wide latitude of the Lend-Lease Bill means that the shortage of aluminum is not clearing up. He asked that substitutes be made wherever possible. "Business as usual" is out and inevitable priorities will always hurt someone. However, on the profit side of the ledger is the fact that we are insuring freedom by arming for defense. Any difficulties we are experiencing now are small compared with what they would be if our efforts should fail.

Production Control Important

"Fundamentals of Production Control," was discussed by C. G. Kopplin, production manager, Union Special Machine Co. It is the function of production control, he indicated, to foresee, organize, order, coordinate and control the determination of what to make, how to make it, how many to make and when manufacturing should start. When production is completed a production control department is not a cure-all for production difficulties; each business has its own peculiar problems and each must have its own solutions. Such a department provides a central control station for building up the manufacturing program and is a relief agency to which all production difficulties can be referred; it sets up a definite group of individuals whose responsibility it is to see that difficulties are overcome promptly so that production can be resumed according to schedule. Mr. Kopplin then explain the production control forum which the Chicago branch of the NMTA has been running for all types of manufacturers from job shop to continuous process industry.

"The importance of foreign trade is constantly decreasing and is very unlikely to regain its former significance," according to Dr. Julius Hirsch, international authority on economics. By mechanizing agricultural production and by chemical treatment of soil as well as by splendid breeding results in Europe, potentialities for a much higher self-sufficiency presents itself to individual countries. In some cases foodstuff production has increased on the same soil by 200 per cent during the past two generations. Thus the present blockade has not the same significance as the blockade of the last war. The tendency toward self-sufficiency extends to industry not only for finished goods but also for raw materials, for constantly creating new substitutes modern technique supports that tendency.

A. L. Kress, director of Industrial Relations, NMTA, lead a panel discussion on job salary and employee rating. Members of the panel were: T. J. Morton, Jr., president, Hoosier Lamp & Stamping; A. S. Redway, vice-president, Farrel-Birmingham; A. F. Sheller, executive vice-president, LeRoi Co.; G. V. Lang, treasurer, United Engineering & Foundry; and R. M. Van Valkenburgh, director of production, Standards Department, Bell & Howell.

"The supervisor in industry today must be different from the supervisor of a generation ago," said Bartley Whiteside, Curtis-Wright supervisor of training recently appointed as consultant on training within industry to OPM. "The metal trades industry which used to require a driver now demands a leader. They must command respect instead of demanding it; they must be diplomatic not dogmatic and take pride in their high calling and consider it an honor to be chosen for a position where they have the double opportunity of serving management and employees. Such attitudes can only be secured by training. In general a supervisor must be trained to do the unnatural thing. The supervisor must convince himself that certain methods developed through experience are superior to those which he might naturally use.

The conference method is the most effective method of training. By placing inexperienced supervisors in a group with experienced and successful supervisors, where ineffective methods will be criticized and effective methods profounded and explained, new men will be convinced that there is real justification for what may have been considered unimportant theory. In the old days a supervisor had little time for personnel problems because he was busy on production angles. Today with planners, inspectors and production engineers, the supervisor has time to handle personal problems of workers. Wright Aeronautical Corp. has expanded its training plan until all supervisors down to leading men are included."

H. H. KERR

Col. Louis Johnson, former Assistant Secretary of War, spoke at the annual dinner attended by more than 600 on "The Job Ahead." Leon Turrou, formerly with FBI, spoke on "Fighting America's Fifth Column."

The National Metal Trades Association reaffirmed its adherence to the essentiality of free management and free workingmen; a man is free to work whether he belongs to a labor union or not.

F. Alexander Magoun, M.I.T., compared industry to a great symphony organization when he said that executives produce no goods; they produce conditions; the right materials at the right time for the right man. The interweaving of the right attitude on the part of worker and management makes for industrial harmony. Force is evidence that a situation is poorly handled. Relationship with any man should be made on the basis of his own individuality. Although millions are spent testing materials, not much is spent on studying and trying to improve our men, he indicated. This should be corrected.

New N. M. T. A. Officers

CHICAGO—A. H. Timmerman, Wagner Electric Corp., St. Louis, Mo., has been elected president, National Metal Trades Association. Other officers are: First Vice President, Roe F. Clark, Package Machinery Co., Springfield, Mass.; Second Vice President and Treasurer, H. H. Kerr, Boston Gear Works, Inc., North Quincy, Mass. Mr. Timmerman has already finished his first year as President of the Association.

A. H. TIMMERMAN

Defense Needs of U. S. for Machine Tools Is Topic at Meeting of Associated Dealers

WASHINGTON—Defense needs of the country for machine tools was the dominant topic at the spring meeting of the Associated Machine Tool Dealers of America at The Mayflower April 28. Because of the pressure of business, the meeting was confined to one day rather than the customary two days. Outstanding on the program were addresses by A. G. Bryant, president, Bryant Machinery & Engineering Co.; Wendell E. Whipp, president, Monarch Machine Tool Co.; and Mason Britton, Chief, Tool Section, Office of Production Management. On the technical side, Philip M. McKenna, McKenna Metals Co., contributed an illustrated talk on "Machining Defense Armaments" and L. B. Gillie, plastics division, E. I. duPont deNemours & Co., talked on the scope of plastics and the attendant machinery problems.

Mr. Bryant took as his theme the remark that Roscoe Conkling made in nominating President Grant for a third term, "He will hew to the line of right, let the chips fall where they may." He emphasized that men in the machine tool industry must continue to produce machines for our vital needs, regardless of where the chips may fall. The embarrassing amount of publicity which the industry has had lately has educated the public to know what machine tools are, how vital their place is not only in national defense but also in creating everything mechanical which adds to our standard of living.

A. G. BRYANT

Dealers and Builders Must Bear Load

"Though the industry has added recently many infants, step-children, cousins and in-laws to the family circle, make no mistake about the fact that after the war the load again will rest fundamentally on the small group of builders and the few score of dealers who in the thirties saved the industry for the country," said Mr. Bryant. "Today machine tool dealers are enlisting literally in the service of the arsenals, navy yards, aircraft and armament plants which desperately need their suggestions as to processes, their advice as to types of equipment, and their help in applying machines to obtain maximum production.

"In one plant a badly needed machine tool arrived suffering from a crack in its base, due to an accident in transit. Here is the head of a prominent machine tool dealer organization, spattered with grease and oil, assisting the maintenance superintendnet to determine how this machine can most quickly be repaired on the job to keep it functioning in a vital production line. A defense plant in another part of the country reached the end of its rope in procurement of necessary skilled machinists. A dealer's sales engineer, through his acquaintance with a variety of types of machine tools, suggested the installation of simplified machines to permit the use of comparatively unskilled labor, and thus save precious days in production.

"Today machine tool dealers, familiar with customers' plants and requirements, have relieved manufacturers to a considerable extent of the burden of giving counsel to new defense manufacturing organizations. Now in the emergency, as in normal times, a vast majority of machine tool users are acquainted with builders in just three ways: (1) through such actual knowledge of the product as the customer may have; (2) the manufacturer's advertising; and (3) through the sales engineer.

"After the emergency the machine tool builder will justify his existence only by producing machines which will meet the economic demands of the future. The dealer will justify his existence only by continuing to offer to the trade its most convenient source for securing information and service as to a variety of tools, and to machine tool manufacturers the most economical as well as the most thorough coverage of the potential market. Today the emphasis is on production; tomorrow it will be on marketing. The dealer must then again furnish the initiative and ingenuity to find applications for his manufacturers' products and to convince potential users of the practicability of new types of machine tools," Mr. Bryant concluded.

Salesmen Vital After War

"The opportunity now afforded the sales engineer to gain first-hand knowledge and experience in the most stupendous tooling-up operation ever undertaken in the world should give him a most valuable preparation for the difficult days that lie ahead after the present emergency is over," said Mr. Whipp in his address. "At that time, regardless of the outcome of the war, American manufacturers will be competing in world markets on an entirely different basis than ever before. With Europe supplied with good machine tools, with European wage rates low, with hundreds of men released from armies and anxious for employment, and with peoples now at war struggling frantically to regain world trade, I look forward after the war to a period of the most intense low-price competition that we have ever seen. The only way that the U. S. can survive and excel in the face of that sort of world economy is to eclipse the rest of the world in low production costs. And to a large extent the impact of this problem will fall upon the designers and builders of machine tools and upon machine tool sales engineers."

WENDELL E. WHIPP

Continuing, Mr. Whipp said, "Today the big cry is, 'How can we get out the work?' But tomorrow the big cry will be, 'How can we cut the cost?' It is my prediction that the machine tool builders of this country will turn out new models after this war is over that will far exceed in productivity anything that has ever been approached today, and it will be your job to go out and sell them."

Plastics Problem Analyzed

The amount of machinery, of tool steel and of other metal products needed in the manufacture of plastic articles was described by Mr. Gillie. He spoke of the misconception that the general public may have of the limits to which plastics may go in replacing metals and other scarce materials required for defense purposes. He related the various types of plastics on the market and told about their properties.

At an executive session George Habicht, Jr., Marshall & Huschart Machinery Co., discussed protection of customers by proper acceptance of orders, and E. W. Lafferty, Swind Machinery Co., talked on the procedure in handling government contracts. F. B. Scott, Jr., Syracuse Supply Co. and president of the association, presided at all the sessions.

"Democracies Will Win the War," Paul Wooton Tells Gear Manufacturers at Annual Meeting

HOT SPRINGS, VA.—Despite Axis victories in the Balkans and Africa, German morale is far below that of the British, according to Paul Wooton, Washington representative, McGraw-Hill Publishing Co., in an address before the 25th annual meeting of the American Gear Manufacturers Association held May 5, 6 and 7. Mr. Wooton's talk reflected the opinion of official Washington. He stated that although 1941 had been expected to be a Hitler year, the war is far from over and condemned the crepehangers who saw only calamity in the news.

The meeting held in a beautiful setting in the Virginia mountains was crowded with technical and business sessions, committee meetings and social events. New officers were inducted into office at the annual dinner Tuesday night.

E. L. Shaner, president, the Penton Publishing Co., addressed the meeting on the subject of "Procuring Materials in Times of Emergency." He explained the functioning of the priorities set-up in Washington and how it affected the manufacturer.

An outstanding technical contribution was a paper by M. Maletz, Kearney & Trecker Corp. His scholarly analysis of the determination of gear tooth form may have a far reaching effect on gear design.

"Special Problems of Aircraft Manufacture," was the subject of a paper by John L. Buehler, Indiana Gear Works. Gear heat treatment and gear grinding were among the operations given special attention by this author.

"Microstructure vs. Machinability" was ably presented by Dr. N. E. Woldman, Eclipse Aviation Corporation. This speaker talked particularly on the carburizing alloy steels and told how treatment affected tool life and finish.

Committeemen were active during the meeting and presented new recommended practices on gearmotors, gear tooth inspection and bevel gears. The gearmotor practice includes the jointly sponsored **AGMA-NEMA** standardized speeds, which program was approved by both associations last fall. All interested manufacturers will place the new standard speeds into regular use within the next few months. The balance of the program will take at least six months because of the necessity of engineering and tooling before manufacturers can be completely adjusted to the new practice.

Credit for the meeting program goes to D. W. Diefendorf, Diefendorf Gear Corp., chairman of the program committee. As chairman of the entertainment committee, N. C. Goin, Westinghouse Electric & Mfg. Co., arranged an enjoyable series of social events.

NEW A.G.M.A. OFFICERS

HOT SPRINGS, VA.—W. P. Schmitter, Falk Corp., has been elected president, the American Gear Manufacturers' Association, for the coming year while J. H. Flagg, Watson-Flagg Co., has been elected vice-president. Other officers are: L. R. Botsai, Westinghouse Electric & Mfg. Co., treasurer; and J. C. McQuiston, secretary. Elected to the executive committee are: W. P. Schmitter; L. R. Botsai; D. W. Diefendorf, Diefendorf Gear Corp.; Paul Christensen, Cincinnati Gear Co.; and D. T. Hamilton, Fellows Gear Shaper Co.

W. P. Schmitter, Falk Corp., (left) gets ready for a golf game with J. H. Flagg, Watson-Flagg Co., during a lag in the proceedings at the annual meeting of the American Gear Manufacturers' Association held at Hot Springs, Va.

L. R. Botsai and S. L. Crawshaw, (left to right) Westinghouse Electric Mfg. Co., relax a moment in their shirtsleeves during the three day A.G.M.A. meeting. J. B. Armitage and M. Maletz, Kearney & Trecker Corp., also attended. Mr. Maletz presented a paper on the Determination of Gear Tooth Form

ANSWER QUESTIONS ON MACHINE TOOL PRIORITIES

Assignment and extension of priority ratings, diversion of machine tools and change in order of delivery, discussed by Ralph Flanders, former Administrator, Machine Tool Priorities Committee

WASHINGTON—In an effort to aid manufacturers having government orders to produce for the national defense program, Ralph E. Flanders, former Administrator, Machine Tool Priorities Committee, and president of Jones & Lamson Machine Co., Springfield, Vt., answers some questions regarding machine tool priority ratings, extension of priorities, machine tool diversions and regarding the possible changes a manufacturer may make in the order of delivery.

The assignment of machine tool priority ratings, Mr. Flanders indicates, is made by:

(1) The Army and Navy Munitions Board Priority Committee on direct government orders (prime contracts) for Army, Navy, and certain other governmental agencies.

(2) Contract officers on first subcontracts through PD-3 certificates.

(3) OPM Priorities Division blanket ratings extended through photostat of certificate.

(4) Priorities Division on PD-1 applications; (a) On documentary showing; (b) Strengthened by report of Army or Navy field offices where necessary.

(5) Priorities Committee of ANMB for Great Britain and Canada, and for any other country which it may become the policy of the U. S. to assist on the request of the appropriate governmental agency.

(6) Priorities Division of OPM for other foreign countries at request of the State Department.

(7) OPM Priorities Division authority and applied by machine tool builder (A-10 only) where the known facts justify a defense rating, and pending receipt of a higher rating from any of above mentioned authorities.

Extension of Priorities

Should contracting officers extend priority rating beyond first subcontractor on production equipment or parts thereof?

No. They may only extend "preference ratings to deliveries of materials which enter directly or indirectly into the manufacture of any materials for delivery under such contract orders." This includes parts and sub-assemblies.

Should contracting officers extend the highest of a number of ratings assigned a prime contractor without respect to actual use of the equipment rated?

No. The equipment must be specifically and definitely required for the work with the higher rating; but unjustified ratings applied previous to this date will be allowed to stand until the orders to which they were applied are filled.

Should he assign the rating of a prime contractor to machines used in the contractor's shop for school purposes whether or not the school is staffed from the public school system?

No. The contract officer should not extend ratings of a prime contractor to machines to be used for instruction. Machine lists for instruction in all cases should be cleared through Mr. Channing R. Dooley, Director, Training Within Industry, OPM. Priorities Division of OPM will make every effort to meet educational needs in some manner.

Order of Delivery on Producers Order Board

Should producers make deliveries in order of priority rating (all A-1-a's first, then all A-1-b's, etc.) except as deliveries are diverted by Priorities Division of OPM?

No. Unless orders are diverted by OPM, he should make deliveries in the order he has promised, if he can make these deliveries.

What rule should producer follow if he falls behind schedule?

In this case he should favor orders with highest priority rating, giving preference within the same rating for machines most urgently needed, when this is unquestionably known.

If production exceeds schedules, should all deliveries be advanced, or new orders be inserted in the schedule?

All delivery dates should be advanced, unless it is definitely known that a customer is not in need of earlier delivery. When the improvement is so great as to affect many machines, Mason Britton's office (Production Division of OPM) should be consulted.

How does a large increased production through expansion on a "Letter of Intent" affect decisions as to the above?

Confer with Mason Britton as for C-3 above.

Is a producer permitted to take non-defense orders?

Yes, if he has excess capacity not needed for defense orders; but in all cases it is most important that orders without a priority rating be postponed when deliveries of defense orders can be advanced by so doing.

Should the machine tool builder leave "holes" in his order board for "emergencies"?

No. Emergencies are taken care of by diversions, as described below. Any "holes" which occur through cancellation should likewise be filled in by diversion. Except for minor general improvement in delivery (see C-3 above) no deliveries in advance of schedule should be quoted or made without reference to Mason Britton's office. All open spaces on order boards arising from any cause should be reported to him at least monthly.

Machine Tool Diversion

Should diversion of delivery from one customer to another be made by the machine tool builder?

No. Changes on order boards can only be authorized by OPM Priorities Division on recommendation of Production Division.

Should a machine tool builder seriously in need of a tool earlier than promised delivery negotiate directly with supplier?

No; he should apply to Mason Britton.

Should a machine tool purchaser apply to the builder for a diversion in his favor?

No. If a prime contractor, he should take the matter up with his contracting officer, who will apply to OPM through the regular channels. If a sub-contractor or sub-sub-contractor, he should go back through his contractor to the contracting officer.

Should diversions be made on machines close to delivery date?

Only in extreme emergencies. Six weeks will be allowed for standard machines, and sixty to ninety days for machines with much special equipment or special features.

Who pays for any special work done or equipment purchased on a diverted machine, when the work or equipment is not required by the new customer?

OPM has no legal control over this, but common sense dictates that the new customer pays for such work or equipment in order to get quick delivery. If he is unwilling to do so, the machine will not be diverted.

FLANDERS LEAVES OPM

WASHINGTON — Ralph E. Flanders has resigned as executive officer of the OPM tools and equipment group and he will resume his duties as president, Jones & Lamson Co., Springfield, Vt. The tools and equipment group is headed by Dean Dexter S. Kimball.

McOMBER JOINS OPM

WASHINGTON—N. F. McOmber, formerly with Jones & Laughlin Steel Corp., The United Alloy Steel Corp., and the Timken Roller Bearing Co., has been appointed Pittsburgh area manager of the Defense Contract Service, a branch of OPM's Production Division.

Canada Doubles Income Tax Rate as War Expenditures Soar; Increases Shipbuilding

MONTREAL—During the present fiscal year, to March 31, 1942, Canada will have to meet an estimated expenditure of $2,668,000. This is approximately $222 for every man, woman and child in the Dominion. The total includes $468,000,000 for non-war purposes; $1,300,000,000 to $1,450,000,000 for Canada's war cost; and $900,000,000 (net) to help out Britain.

Canada plans to raise at least 73 per cent and perhaps 79 per cent of this budget through taxation, the largest percentage to be raised through taxes, rather than borrowing, in any country at war in the world. In the last war Canada raised 47 per cent of its total expenditures through taxation. During the last year 61 per cent of expenditures came from taxes. Federal taxes and borrowing, plus provincial and municipal taxation, will take 54 per cent of Canada's national income this coming year.

To meet this expense, Canada's 12,000,000 citizens will have to pay a more than doubled national defense tax and a more than doubled income tax, in addition to many other levies. The personal income tax rate will start at 15 per cent for the first taxable $1,000, and increase by 5 per cent for each additional $1,000. Although the excess profits tax on corporations is unchanged at 75 per cent of the amount by which taxable income exceeds average profits of the last three years, the minimum rate a corporation is required to pay as income tax has been raised to 40 per cent.

Long Range Ship Program

Canada has begun large scale ship construction program, even though most of the planned ships won't be complete for several years. A program already has started for the building of 96 more merchant ships, of 10,000 tons each at a cost of about $175,000,000. It is hoped that the last of the 96 ships will be completed by the end of 1943. Burrard Dry Docks, Ltd. will build 42 of the ships; North Vancouver Ship Repairs, Ltd., will be equipped to build 28 ships, while Victoria Machinery Depot, Victoria, B. C.; Yarrows, Ltd., Esquimault; and Canadian National Dry Rock, Prince Rupert, will each build ten ships. Eastern shipyards will continue to build warshaps. Most of the 110 corvettes and 60 steel minesweepers have been completed.

Capital investment in new plants for making guns in Canada has now reached $400,000,000. Canada has undertaken to make every line of gun from Army rifles to 6-in. naval guns. By mid-summer, guns will represent the country's largest munitions export.

Two new types of heavy tanks are now in production and by next month infantry tanks will be in substantial production. By mid-summer Canada will be making large numbers of cruiser tanks.

Of the Dominion's present output of 45 airplanes weekly, 40 percent are fighter planes. The number of workers in the airplane industry has increased to 22,000 from the 1,000 at the start of the war.

The following contracts have been let recently by the government: Shipbuilding: Star Shipyard, Ltd., New Westminster, B. C., $106,256; and Victoria Machinery Depot Co., Ltd., Victoria, $1,312,000.

GUN CONTRACTS INCREASE

DETROIT—Reports that the government is anxious to increase production of machine guns are confirmed by information that General Motors contracts for 30 and 50 caliber machine guns will be or have already been doubled. Navy officials are credited with saying that the original contract signed with the Pontiac Motor Division for the Oerlikon 20-mm. 400-shot per minute automatic anti-aircraft cannon will be doubled or tripled in the near future. Pontiac was in production soon after signing the contract.

OPM Imposes Inventory Control to Prevent Accumulation of Excess Stocks of 16 Metals

WASHINGTON—A new form of inventory control, designed to prevent the accumulation of excess stock and supplies, is being applied at once to 16 metals and classes of metals by the Priorities Division, Office of Production Management. All the metals affected are important in the defense effort.

The control imposed provides that, in general, shipment of the metals affected may not be made to customers in amounts which would increase the customers' inventory to unnecessary levels. For the time being, the control is implemented by requirement that both customers for these metals and suppliers must file sworn statements covering compliance with the regulations.

The metals covered in the new inventory control system, all of which are to be added to the Priorities Critical List are:

Antimony	Manganese
Cadmium	Mercury
Chromium	Molybdenum
Cobalt	Non-ferrous alloys
Copper	Tin
Ferrous alloys	Vanadium
Iridium	Iron and steel products

Suppliers will be required to fill out an OPM questionnaire, which will be distributed shortly, and which will require that suppliers give complete information regarding their inventories. Customers who hold excessive inventories will be denied supplies until their stocks are reduced to "reasonable levels." Compliance affidavits must be filed by producers, primary and secondary smelters, remelters, brokers, warehouse and wholesale distributors, processors and fabricators. Persons sending in false affidavits can be prosecuted for perjury, and the OPM will prevent them from making deliveries by court injunction.

The new plan is limited to the inventory situation and does not constitute mandatory industry-wide allocation. So far industry-wide control, governing the overall distribution or allocation of supplies, has been imposed in seven cases — aluminum, magnesium, nickel, nickel-bearing steel, ferro-tungsten, machine tools and Neoprene. In addition, zinc is subject to partial control through a production tool. Zinc producers are required to set aside a certain percentage of their monthly production for the pool, out of which the priorities division can allocate to meet urgent situations.

U. S. Builds 3,500,000 Tons of Shipping in 1942

WASHINGTON—Last fortnight the first keel in the new program of 312 box-bottom ships designated as EC-2, was laid down by Bethlehem at Baltimore. Keel-layings will be almost daily occurrences from now on, what with the old 50-ships-a-year schedule of the Maritime Commission pushed up to 285. It is expected that 3,500,000 tons of shipping will be built in 1942.

Meanwhile the Commission is exercising its new authority to negotiate contracts by modifying some existing contracts which were made under the bidding system, which, most every one agreed, put Commission construction at a disadvantage against negotiated Navy building.

Meanwhile also, Congress is considering the Hill-Boykin bill, which would encourage the private building of new merchant ships by unsubsidized lines in either foreign or domestic commerce. This would be done by exempting these lines from taxes on earnings which are set aside for new tonnage.

INSIDE DETROIT

Stabilization of auto output after Aug. 1 was asked by the OPM but not made public. A formula will prevent excessive assembly rates in first six months to stabilize consumption of materials

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—More than meets the eye was contained in the auto-curtailment program announced by the OPM on May 5. Letters from Washington to the individual manufacturers specified total assembly allottments for the twelve months beginning Aug. 1, and furthermore laid down a formula which is designed to stabilize assembly operations in the first six months of that period in order to permit the government to plan allocation of materials. The formula was not made public, but its existence is vouched for by a reliable source.

The formula works in this manner: Each manufacturer shall calculate his maximum assembly schedule for the six months beginning Aug. 1 by applying to his annual allottment the percentage of his Aug. 1, 1940-Aug. 1, 1941 production turned out in the first six months of that period. Discussed but not adopted was a proposal to limit production in the first three months to 60 per cent of the maximum allowed in the first six months. Elimination of this proposal forecasts heavy assembly rates in the early Fall in anticipation that further cuts will be made as national defense or as war economy dictates. Washington now admits what the auto industry has been saying for weeks—a 40 to 50 per cent slash in next year's output will probably be required, particularly in view of President Roosevelt's demand for 500 heavy bombers per month. The Ford plan for a mile and a quarter long plant to make complete bombers on an automotive type assembly line is coming closer to a reality.

Formula May Prove Detrimental

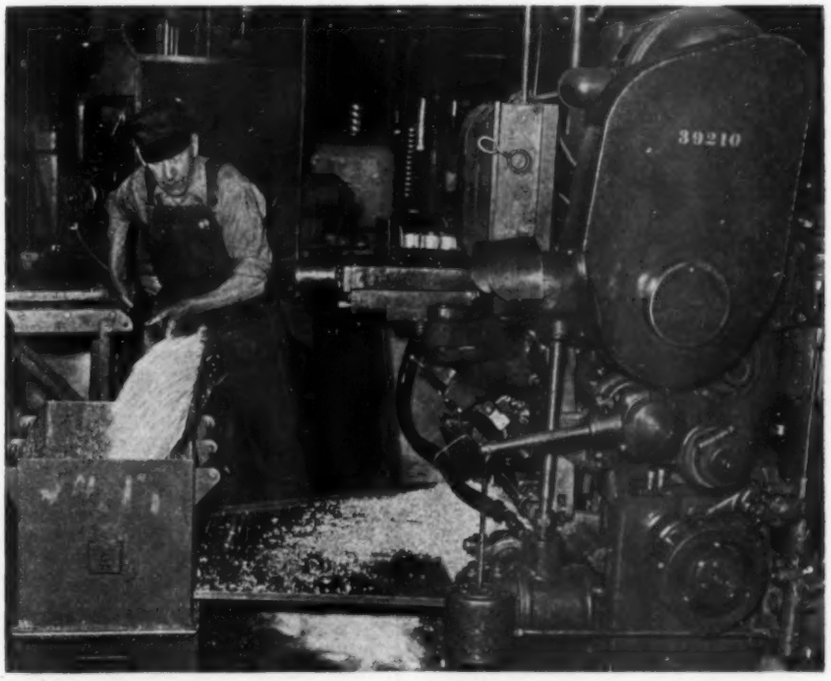
Rigid application of this formula may prove detrimental to concerns which made a slow production start on the 1941 model season, experienced assembly difficulties or strikes, or did not enjoy the best competitive sales position. Yet it is evident that the government is not anxious to kill off one of its best tax and employment sources, as evidenced by this statement in the OPM release: "The allotments to the individual companies give due regard to the necessity of maintaining the relative position of the different companies in the industry, their size, field organization employment and their relative position in regard to passenger vehicles and trucks. It is the hope of the Office of Production Management that the materials saving desired has been attained intelligently."

The heaviest hand was placed on the three major corporations which produce approximately 90 per cent of the nation's output. General Motors, Ford and Chrysler were cut 21.5 per cent. Independent passenger car manufacturers were cut 15 per cent, the larger truck manufacturers by 10 per cent and the smaller truck makers by 5 per cent. Companies producing fewer than 2,000 vehicles annually were exempted from the curtailment order. The allottments were made after all companies submitted briefs concerning their anticipated production in the twelve months ending Aug. 1, together with supporting data outlining their competitive position and the probable effects of an impartial slash, at first anticipated in the neighborhood of 20-25 per cent. Such relief as was accorded the independents was heartily approved by the major companies which have no desire to lose the stimulation of competition nor to attain the position of becoming near monopolies.

According to the OPM estimate 5,289,972 cars and trucks will be produced in U. S. plants in the twelve month period ending Aug. 1. From Aug. 1, 1940 through March, 1941, output from these plants amounted to 3,335,445 units, leaving 1,954,527 vehicles to be produced in April, May, June and July. April operations were adversely affected by the Ford strike and that company has decided to operate six days a week for practically the balance of the model year in order to make up lost ground. Other manufacturers are largely planning to continue peak assembly rates on a five-day week basis. Domestic assemblies in May and June should reach at least 525,000 units.

EFFECT OF AUTO CURTAILMENT

DETROIT—It is idle to speculate on the effect of the auto curtailment program upon unemployment and the number of persons who can be diverted to defense. Auto payrolls do not exactly follow the production curve. On an average, 447,000 persons were employed in auto, body, assembly and parts plants in 1940. To say that an industry curtailment averaging 20 per cent will release 100,000 or so workers for defense neglects the factor of availability. Cutting back the payroll in a parts-plant city where there are no defense contracts will be of no benefit.



Salvaging Scrap—*To offset the great annual consumption of materials, the auto industry returns enormous quantities of scrap to processors. At Buick, which conserves 112,000-tons of materials annually, a workman is removing metal cuttings from a machine which cuts grooves in pistons*

Defense Power— *In the tank and plate shops of Allis-Chalmers Mfg. Co., Milwaukee, (at left) a 39,000-kva. waterwheel generator yoke is being welded on a new large hydraulic welding positioner. This 50,000-lb. piece is approximately 38 ft. 8 in. in outside diameter. The welding positioner can be rotated and tilted to any angle position from horizontal to vertical*

To cover themselves on the balance of 1941 model production, and perhaps to assure supplies of parts and materials that are interchangeable on the 1942 series, auto companies increased orders to parts makers during and immediately following the negotiations for the curtailment program. There is talk that a major producer added 100,000 units to its 1941 model program.

There is also the matter of worker suitability. Denfense jobs are new jobs. Not for nothing have defense contractors largely decided to employ and train jobless younger men from 18-25. Older workers would have to be retained in many cases and they do not learn as fast as the younger, more ambitious group. There is also the matter of pay while learning. Defense plants pay in the neighborhood of 50 cents an hour to trainees, 75 cents when the trainee qualifies as a machine operator. Time and a half is paid for Saturday work, six days a week being worked now although the original contract basis stipulated five at straight time. Already top heavy in administrative and engineering expense, it is small wonder that defense plants are not anxious to employ older workers at a higher rate and go through the same or worse grief in training them. Yet that will be done when the auto industry gets deeper into the defense program.

Detroit observers attached special significance to two events, in their consideration of the arbitration efforts of the National Defense Mediation Board in the GM-UAW dispute. Publication by government sources of data on rising living costs was considered an "assist" to strengthen the union's demand for a blanket increase of ten cents an hour. The corporation had offered from two to five cents, depending on job classification, and has revealed itself adamant on the subject of a ten cent raise. It is understood that if a strike is to come it might as well be now because the officers are tired of having the company used as a guinea pig in labor's attempts to increase auto wages and its hold upon auto labor.

The second event which raised eyebrows was the sudden strike action brought at the Packard Electric Div., Warren, Ohio. A set of rather minor grievances was discarded over night by the United Electrical, Radio & Machine Workers of America (C.I.O.) which then brought in a set of ten demands very much on a par with those of the UAW-CIO. It is interesting to note that a member of the Mediation Board panel seeking to arbitrate the GM-UAW dispute is James Carey, head of the above electrical workers' union. That union has never won an election at the Packard Electric Div., in fact it is reported never to have asked one in the past five years.

U. S. BOATS BUILT IN CANADA

WASHINGTON—To speed production of mosquito torpedo boats for Lease-Lend to Britain, the U. S. will allocate some of them for construction in Canadian naval yards. Thus, this country buys from a British dominion and gives back to the British. A further complication is that the British have been buying munitions and agricultural products from Canada for cash, but now that Britain can get these goods from us on Lease-Lend, Canada is losing its market. And Canada, sooner or later will ask the U. S. for financial assistance.

Synchronization of Armament Program Is OPM's Real Job

WASHINGTON—Underlying duty of OPM and of its predecessor the Defense Commission has always been to see to the synchronization of the armament program—to see that when a thousand airplanes or a hundred ships are needed, the metal and the men and the tools are there. And the complaint which has become so common among defense executives as to be almost a cliche is that they can't find out what the program is; that no sooner are they told that a million gimmicks are wanted than they learn that no, it's five million, plus a hundred thousand gadgets. This is why, for instance, Stettinius said there was plenty of aluminum and three months later was rationing every pound, why the Gano Dunn report said there was plenty of steel and hardly more than a month later was repudiated by the steel industry.

Gradually the realization is growing that there isn't, and in the nature of things can't be, any schedule of armament needed. The program is simply to produce all that can be produced. This does not mean, however, that planning is impossible. The conception is being pushed in OPM that the job now is to determine what factor sets the limit of capacity. This determined, it is argued, it would be possible to set up, at least roughly, in terms of the military relationship between different types of weapons, a schedule of arms production which can be projected.

Mining Seen as Bottleneck

One theory being presented is that the most likely limit is the ore extraction capacity in some basic metal, that refineries and factories can be expanded faster than mines. The use of copper for instance is now approaching the capacity of all available mines.

Copper is a convenient example because, once all present inescapable uses are deducted, remaining tonnage can be converted into terms of shells. Every weapon of war is either a gun or a device to carry or service a gun. Hence, knowing how many shells can be made, it's a straightforward military problem to decide how many should be fired from airplanes and how many from tanks. So that a quantitative estimate of nearly all kinds of armament can be roughly computed. It is then merely a technical problem to determine how much aluminum is needed, how many machinists, how much factory floor space.

Then, by projecting into the future the rate at which new mine shafts can be brought in, the schedule can be projected forward—to the point where some other resource becomes the limiting factor. In these terms, a well-planned armament production program is not one without bottlenecks but one in which all bottlenecks are reached at the same moment.

WATCHING WASHINGTON

Some eight U.S. tank divisions are projected and will require about 3,176 units. Five tank contracts have been let; only Rock Island and American Car & Foundry are in full production

By BLAINE STUBBLEFIELD

WASHINGTON—Hand-made war is going out. The most recent demonstration of this was given by the Nazis in the Balkans. One tank, with a crew of four men, has the destructive power of 40 men, is ten times as fast. U. S. Army plans eight armored divisions. Two are completed; two more are being activated; four more are on official paper. In addition, five separate armored battalions, may form a kind of GHQ force similar to that of the Air Corps, and would use heavy tanks. Germany has 15 to 30 armored divisions.

Five tank contracts are in the works: Baldwin Locomotive and American Locomotive are on medium tanks on a cost-plus-fixed-fee basis; Chrysler has mediums on a fixed fee plus, dollar-a-year lease; American Car and Foundry is in production on light tanks at a fixed price per unit in two plants, one at Berwick, Penna., and one at St. Charles, Mo. The Rock Island Arsenal is in production of light and medium tanks. The only heavy tank project at this time is an educational order with Baldwin Locomotive.

Only the Rock Island Arsenal and ACF are in production. The others have built only pilot units, "launching" of which was the occasion for all the recent news fanfare. These three will not turn out tanks till some time in midsummer. Total contracts for plant and facilities, $33,010,000.

About 397 Tanks in Each Division

Of course the number of tanks being produced, and on order, is restricted information. However, it is possible to arrive at fairly useful estimates from known facts. Official Army statements, published by Army Ordnance Association, give each armored division 287 light tanks and 110 mediums, or 397 for each division. For the present four divisions (two in the field and two forming) 1,588 units would be required. For the total eight divisions projected 3,176 are needed. This would be exclusive of any heavy tanks for the five separate GHQ battalions.

Another angle on quantity is the statement of F. A. Stevenson, vice-president of American Car and Foundry, published by Army Ordnance Association, that the company's original contract called for 329 light tanks. This contract has, however, been supplemented with additional orders since then. ACF recently was building three units a day, and there is reason to suppose that this rate has been stepped up to four or five.

Other figures, obtained by AMERICAN MACHINIST from confidential sources, indicate that by August the cumulative production of medium tanks will be 100, and that of light tanks, 1,000. Perhaps some of the output is going to the British. Furthermore, tanks are highly expendible in action, and the aim of this country is to establish a high productive capacity.

Enormous Production Seen

Pressure for tank production hinges on the turn of war. Right now, airplanes, ships, and machine and anti-aircraft guns are more urgent. The priority rating on tanks is A-1-g, which is pretty low; only combat cars and heavy guns are lower. This low priority rating would seem to indicate that tanks are not being rushed to the British now.

But tank construction will be enormous, soon or late. A hint as to what this will mean to manufacturers is revealed by Mr. Stevenson in his report on the ACF project. After a check-up at the Rock Island Arsenal, the company felt well fitted to make tanks, because of its experience with big forgings, castings and pressings for rail cars. Its preliminary cost estimate took seven weeks, 2,600 blueprints. Its bid was low and was accepted in five days.

The first tank was constructed of soft plate. The first unit, made of hard plate, all according to specifications, was accepted by U. S. Ordnance, April 1, 1940. The company was committed to deliver in 200 days; actual delivery was in 184 days. After ACF decided to undertake the job, it was found that the heavy plate manufacturers could not meet the time schedule, so the company had to build its own heavy plate plant. This job, plus the setting up of 75 machine tools in the fabrication plant, was accomplished in four months. It was soon discovered that tanks, which are subjected to violent shock as compared with rail cars rolling on smooth steel, require greater precision throughout.

Tanks Designed for Lightness

Contrary to popular belief, tanks are designed for lightness, considering the job to be done, and considering the two-inch armor necessary to resist up to 37-mm projectiles. Since the plate is necessarily heavy, the tank has no chassis; the plate forms the frame. The main assemblies are transmission, hull turret, suspensions, track, clutch, gunmounts, and engine.

It is partly to achieve lightness that air-cooled aircraft engines are used. In addition, these engines require less space; they take no water, which is sometimes unavailable and which would need anti-freeze. A ruptured liquid-cooling system would, of course, disable the tank. At present three types of airplane engines are powering tanks: Guiberson Diesel, Wright 450 hp., and Continental, all radials. Because tanks move slower than airplanes, cooling is forced by an air blower.

The light tank weighs 11½ tons; has a speed of 37.5 m.p.h., carries one 37-mm cannon and four .30 caliber machine guns, costs about $25,000, has a "mobility" of 2,000 miles, is manned by a crew of four. Just what is meant by "mobility" is not clear. Certainly it would have to take fuel at less distances. Probably it means replacements of parts would be necessary. Weight and speed vary in different statements. Equipment carried varies the weight. The speed quoted here is probably cruising. Official statements say tanks can do 50 m.p.h.

The medium tank weighs 21 tons, makes 32 m.p.h. carries eight 30 caliber machine guns, one 37-mm cannon, and one 75-mm cannon which is approximately equivalent to the famous French 75" field piece, a crew of six.

Biggest to be About 50 Tons

The emphasis is definitely on light and medium tanks. The War Department is interested in heavy tanks, and is pushing design and development, including the Baldwin educational order. But in the end it may be found that too much maneuverability and mobility would be lost. Rapid movement and fire power are increasingly important. The Germans seem to have used 70 and 80-ton tanks, but full reports are not in on their effectiveness. Army's heavy tank probably will not exceed 50-tons.

The U. S. has some advantage in the tank line because of its pre-eminence in automotive and rail equipment manufacture. Americans invented the caterpillar track. The British developed the tank in the last war. Not until 1930 did Congress appropriate money ($280,000) for a modern tank project. Last July 10 the Army had 400 tanks of all types, many obsolescent. Army claims that it long has had plans for an armored force like the Panzer, and was not surprised. Among the features being incorporated and improved in tanks are: cold-weather starting, power turrets, electrically controlled guns, indirect vision and periscopic sights, padding for the crew. Design change is and will be constant, as in aircraft.

New York Survey Spurs Subcontracting Drive

ALBANY, N. Y.—To hasten and expand further the program of farming out defense production work, the New York Division of State Planning has completed plans for subcontracting clinics to be held throughout the State. The basic plan for each clinic calls for a general meeting in each area of potential subcontractors interested in defense.

The Division distributed 40,000 questionnaires among local defense councils which were used by them in gathering information on manufacturing facilities in their communities; this included data on the closest tolerance to which each company was accustomed to work metal products; exact information on the type, number, name, model or capacity, age and condition of each machine, and the total machine hours available for a 24-hr. day.

This specific information has made it possible for the division to refer inquiries from prime contractors needing subcontracting facilities to scores of small manufacturers throughout the states whose returns indicated that they had metal-working facilities capable of doing the type of work required.

Many Firms Uncertain As to Vacation Plans

NEW YORK—A great many companies are still uncertain whether production demands or other factors will make it necessary to modify existing vacation policies, it was indicated in a survey conducted by the National Industrial Conference Board, Inc. Among the 246 companies represented in the survey, 63.4 per cent state, however, that no change in the ordinary vacation policy is contemplated.

The government's attitude may be expressed by the Office of Production Management which suggests that companies pay the worker for his vacation even though he doesn't take it. In this event there will be no additional cost to the company, because the company would have to pay for the vacation anyway. OPM also suggests that the company delay the vacation period until some future date and that defense industries pay bonuses to workers who voluntarily forego vacations this year, so that production will not be impeded.

E. C. BRANDT AIDS O.P.M.

EAST PITTSBURGH—E. C. Brandt, sales manager, Renewal Parts and Service Div., Westinghouse Electric & Mfg. Co., has been appointed to the Office of Production Management. Mr. Brandt has been granted a leave of absence from Westinghouse and while he is serving with the government H. R. Meyer will take over his work.

LARGEST SHIP PROGRAM

WASHINGTON—"Our nation is now engaged upon the largest shipbuilding program in the history of the world," said Sidney Hillman, associate director general, Office of Production Management, before the gathering at the Atlantic Coast Zone Conference of the Shipbuilding Stabilization Committee. "The total appropriations and authorizations in this program to date call for the expenditure of $9,200,000,000. This will require 2,300,000 man-years of labor. "Out of the total authorized or appropriated by Congress, $5,400,000,000 is already under contract. And of this sum $4,000,000,000, or 75 per cent, has been awarded to 37 private shipyards and six U. S. Navy Yards on the Atlantic Coast. The Atlantic Coast contracts demand a year's work by 600,000 men."

ASTE Offers Literature To Aid in Labor Training

DETROIT—Literature for use in emergency training of defense workers for a wide variety of occupations, has been prepared by the Emergency Defense Training Committee, American Society of Tool Engineers and is available for such subjects as, heat treatment, job series, measurement, drill press, bench work, blueprint reading, lathe operation, and shop mathematics. New literature describing milling machine and shaper operation courses will be available July 1. A technical advisory committee of the Society is being set up at the present time for the purpose of reviewing and passing on further instructional data on the subject of tool designing and tool engineering for use in the defense and industrial educational work. The literature is available at cost through the cooperation of the N. Y. Bureau of Industrial and Technical Education.

U. S. Government Contracts Awarded to Metal-Working Firms

(Does not include contracts under $100,000)

Source	Agency	Commodity	Amount
Clayton Mfg. Co., Alhambra, Calif.	Navy	Steam generating unit	$125,934
Taylor-Wharton Iron & Steel Co., Easton, Pa.	War	Ammunition	2,710,404
Tredegar Iron Works, Richmond, Va.	"	"	157,512
Kennedy-Van Saun Mfg. & Eng. Corp., Danville, Pa.	"	"	819,072
Crane Co., Chicago, Ill.	Navy	Steel valves	167,952
Harding Machine Screw Co., E. Liberty, Ohio	War	Battery cups	107,020
American Steel & Wire Co., Donora, Pa.	"	Wire	152,025
Reynolds Metals Co., Lister, Ala.	Navy	Aluminum alloy	2,963,566
Revere Copper & Brass, Inc., Rome, N. Y.	"	Condenser tubes	117,292
Mueller Brass Co., Port Huron, Mich.	War	Brass	113,660
Consolidated Machine Tool Corp., Rochester, N. Y.	Navy	Boring machines	117,865
Axelson Mfg. Co., Los Angeles, Calif.	"	Lathes	1,168,082
Gardner-Denver Co., Quincy, Ill.	"	Air compressors	137,842
Yates-American Machine Co., Beloit, Wis.	War	Wood-working machy	179,696
International Diesel Elec. Co., Inc., L. I. City, N. Y.	Navy	Generator sets	249,727
York Safe & Lock Co., York, Pa.	War	Gun mounts	3,013,010
Allis-Chalmers Mfg. Co., Milwaukee, Wis.	"	" "	5,134,998
Worthington Pump & Mach. Corp., Holyoke, Mass.	"	" "	4,718,400
Consolidated Machine Tool Corp., Rochester, N. Y.	Navy	Mills	2,249,970
Monarch Machine Tool Co., Sidney, Ohio	"	Lathes	992,601
Phelps Dodge Copper Products Corp., Yonkers, N. Y.	"	Elec. cable	1,361,090
General Motors Corp., Norwood, Ohio	War	Ambulances	173,042
Mathis Yacht Bldg., Co., Camden, N. J.	Navy	Sub. chasers	287,000
Commercial Iron Works, Portland, Ore.	"	Minesweepers	4,770,500
Gen. Engineering & Dry Dock Co., Alameda, Calif.	"	"	7,472,000
American Shipbuilding Co., Cleveland, Ohio	"	"	13,736,000
Pennsylvania Shipyard, Inc., Beaumont, Texas	"	"	7,200,000
Savannah Machine & Foundry Co., Savannah, Ga.	"	"	5,100,000
Winslow Marine Ry. & Shipbldg. Co., Inc., Seattle, Wash.	"	"	7,635,668
Jeffersonville Boat & Machinery Co., Jeffersonville, Ind.	"	Sub. chasers	2,458,900
Albina Engine & Machine Works, Inc., Portland, Ore.	"	" "	2,520,000
Dravo Corp., Pittsburgh, Pa.	"	Minesweepers	3,469,500
Jakobson Shipyard, Inc., Oyster Bay, N. Y.	"	"	1,234,000
Penn-Jersey Corp., Camden, N. J.	"	"	1,350,000
Charleston Shipbuilding & Drydock Co., Charleston, S. C.	"	Fleet tugs	8,100,000
United Engineering Co., Ltd., San Francisco, Calif.	"	" "	5,465,372
John H. Mathis Co., Camden, N. J.	"	Minesweepers	4,950,000
Consolidated Shipbuilding Corp., Morris Hts., N. Y.	"	Sub. chasers	1,240,000
Dravo Corp., Pittsburgh, Pa.	"	" "	3,142,500
Leathem Smith Coal & Shipbuilding Co., Sturgeon Bay, Wis.	"	" "	1,200,000
Nashville Bridge Co., Nashville, Tenn.	"	Minesweepers	1,348,000
Luders Marine Construction Co., Stamford, Conn.	"	Sub. chasers	1,908,000
Platzer Shipbldg., & Drydock Co., Houston, Texas.	"	" "	2,552,000
Sullivan Dry Dock & Repair Corp., Brooklyn, N. Y.	"	" "	2,500,000
Fairchild Aviation Corp., Jamaica, N. Y.	War	Computers	472,479
Sperry Gyroscope Co., Inc., Brooklyn, N. Y.	Navy	Gyro compasses	122,436
Pollak Mfg. Co., Arlington, N. J.	"	Ordnance	1,156,932
Worthington Pump & Machy. Corp., Washington, D. C.	"	Compressors	326,291
Baldwin-Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.	"	Planers	105,500
Revere Copper & Brass, Inc., Baltimore, Md.	"	Tubes	148,519
General Motors Corp., Detroit, Mich.	War	Trucks	4,289,613

NAMES in the NEWS

Arthur L. Armantrout has been appointed superintendent of Industrial Relations of the Lorain Div., at Johnstown, Pa., Carnegie-Illinois Steel Corp.

Walter L. Brown has been made vice-president and general counsel, Western Electric Co.

John Heronymous, has been elected president, the American Hydraulics, Inc., Fond-du-Lac, Wis. Chester H. Schmidt and Harry A. Schauer have been named vice-presidents.

L. Clayton Hill has been appointed vice-president and general manager, Murray Corp. of America. Mr. Hill, who has been associated with the corporation since 1927, became works manager in 1933.

Basil T. Horsfield, manager of the Aluminum Production Div., Reynolds Metals Co., Richmond, Va., has been elected a director of the company.

Don A. Luscombe has been named head of the aircraft parts division of the Louisville, Ky., plant of the Reynolds Metal Co.

C. H. Matson has been appointed assistant manager, Fort Wayne works, General Electric Co. R. H. Chadwick has been named assistant to the manager in charge of engineering and E. J. Thomas has been appointed engineer of the specialty transformer department.

A. L. Patrick, formerly executive vice-president and treasurer, has been elected president, Cleveland Automatic Machine Co., Cleveland, Ohio, succeeding Walter F. Crown, who has resigned.

William Smila has been named master mechanic, Plymouth Motor Corp., Detroit. He succeeds Otto W. Franke, who has been transferred to the Dodge division as general master mechanic.

Joseph J. Strachan has been appointed assistant to the president of Carnegie-Illinois Steel Corp. He was formerly assistant chief engineer, Pittsburgh district.

John J. Toth has purchased the Bridgeport, Conn. branch of the New England School of Practical Training which he will operate in conjunction with the Toth Engineering & Tool Co., Bridgeport, Conn.

George W. Veale, former manager, Bumper Div., and more recently with the Axel Div., Eaton Mfg. Co., Cleveland, Ohio, has been named a vice-president of the company. Daniel Dewey, manager, Stamping Div., Charles C. Bradford, manager, Heater Div., and Joseph L. Dostal, manager, Foundry Div., have also been named vice-presidents.

President, Vice-President, Chairman, Inland Steel Co.

WILFRED SYKES

JAMES H. WALSH

PHILIP D. BLOCK

Wilfred Sykes has been elected president, Inland Steel Co., succeeding Philip D. Block, who has been president of the company for the past 22 years, and who has been elected chairman of the executive committee. L. E. Block, who served as chairman of the board for many years, has been elected chairman of the finance committee. James H. Walsh has been elected vice-president in charge of steel works. Edward L. Ryerson, chairman of the board has been reelected.

Philip D. Block, who, together with his brother, L. E. Block, has been largely responsible for the phenomenal growth and outstanding success of the Inland Steel Co., was one of the original founders of the company in 1893. He served as vice-president of the company prior to 1919 at which time he became president.

Ralph S. Damon has been elected president, Republic Aviation Corp., to succeed W. Wallace Kellet, who has been appointed chairman of the board. Mr. Damon will be chief executive officer of the corporation and will remain a vice-president and director of American Airlines, subject to approval of the Civil Aeronautics Board.

PLANT EXPANSION

Acme Electric Welder Co., Vernon, Calif., is building a new factory addition at a cost of $20,100.

Kollsman Instrument Div., Square D Co., has erected a new building at Elmhurst, N. Y., which contains no iron or steel. The building will be used for the assembly and adjustment of magnetic compasses, aircraft instruments.

Lempco Products, Inc., Bedford, Ohio, will increase its equipment assembly facilities 200 per cent in an expansion program to begin shortly.

The Lindberg Engineering Co., Chicago, has recently moved into a section of a new $125,000 plant now under construction.

The Parker Appliance Co., Cleveland, Ohio, has launched an expansion program of $2,000,000 to increase its plant facilities. The entire program will be financed by the company.

Rheem Mfg. Co., Chicago, has completed a $1,000,000 expansion program and has started production on a

Heads Republic

RALPH S. DAMON

Murray Corp. V-P

L. CLAYTON HILL

$3,051,657 order from the government for bomb practice bodies.

The Star Electric Motor Co., Bloomfield, N. J., recently purchased a new addition to its production facilities in the form of a plant formerly owned by the American Publishing Co. The new plant contains 165,000 sq. ft. of floor space.

BUSINESS ITEMS

Aircraft, Inc., Los Angeles, is a new corporation organized with 2,500 shares of no par value stock.

Allied Engineering & Shipbuilding Corp., Los Angeles, has been organized with a capital of $250,000.

The Atlantic Instrument & Tool Co., Inc., New York, N. Y., has just been organized for the manufacture of precision measuring instruments, adjustable snap gages and other tools.

Berlin & Russell Aircraft Machine & Mfg. Co., Los Angeles has been organized with a capital of $500,000.

California Well Tool & Machine Works, Los Angeles, has recently been organized.

M. D. Galbreath is now trading as the Galbreath Machinery Co., Pittsburgh, Pa. He was formerly treasurer of the Marr-Galbreath Machinery Co. which discontinued business April 30, 1941.

Hinds Nut Lock & Bolt Co., San Bernadino, Calif. has been incorporated with a capital of $200,000.

Maxim Kolmer, New York Industrial Engineer, is the head of an eastern group which has purchased the Akron Machine, Mold, Tool & Die Co., Akron, Ohio. Mr. Kolmer will act as vice-president and treasurer of the company. M. H. Bernke, founder and president of the company, has retired.

R. D. LeTourneau, Inc., Peoria, Ill., has purchased the Avery Farm Machinery Co. plant in Peoria. The sale includes all Avery buildings and equipment.

Newport Shipbuilding Co., Los Angeles, has been incorporated with a capital of $75,000.

Oceana Tool Mfg. Co., Inc., Santa Monica, Calif., has been incorporated with a capital of $25,000.

Quality Tool Co., Los Angeles, has recently been formed by John E. McCullough.

The Sheldon Machine Co., Inc., Chicago, is consolidating its two present Chicago plants in a new plant which is scheduled to be completed June 30.

OBITUARIES

Francis E. Brown, chairman of Messrs. David Brown & Sons, Ltd., Huddersfield, England, died at the age of 67. He first joined the company, which was founded by his father in 1860, as an apprentice in 1889. The business of David Brown & Sons, however, in its present form, was originated by him.

Frederick C. Bryan, 77, for thirty years general traffic manager, Allis-Chalmers Mfg. Co., Milwaukee, Wis., died recently.

Edward W. Burbank, 52, former manager, Allis Chalmers Mfg. Co.'s Dallas, Texas district office, from 1922 to 1940, died April 20, after a prolonged illness. He started with the company as a student apprentice in 1911.

George H. Denner, 67, president, the Pittsburgh Piping & Chimney Co., Pittsburgh, Pa., died recently. He helped to found the company which he headed since 1903.

Alexander Glass, 81, chairman of the board, Wheeling Steel Corp., Wheeling, W. Va., died at Lake Wales, Fla. In 1902 he became vice-president of the Portsmouth Steel Co., and was named president in 1910. In 1920 the company merged with the Labelle Iron Works, a firm which had been founded by his father, and with the Wheeling Steel & Iron Co. to form the Wheeling Steel Corp. At that time he became chairman of the board, a position which he held until his death.

Herbert O. Kent, 54, former vice-president and general manager, Potter & Johnson Machine Co., Pawtucket, R. I., died suddenly at Providence, R. I., on April 27.

Edwin A. Marvel, 87, president, Curtis & Marvel Machine Co. and Fremont Co., died at his home in Worcester, Mass. He became president of both companies in 1910.

John Mueller, 73, president and founder, the Brookside Brass Foundry & Mfg. Co., Cleveland, Ohio, died last month.

George R. Munschauer, 61, president, Niagara Machine & Tool Works, Buffalo, N. Y., died April 24. He became president of the company 23 years ago.

J. Watson Owings, 56, metallurgist, Meehanite Metal Corp., Pittsburgh, Pa., died recently. He had been with the company since 1936.

William T. Randall, 57, sales engineer, Pangborn Corp., Hagerstown, Md., died suddenly of a heart attack on April 14.

Crane President Dies

CHARLES B. NOLTE

Charles B. Nolte, president since 1935 of the Crane Co., manufacturers of plumbers' supplies, died in Chicago on April 29, at the age of 55.

Mr. Nolte, who was also a director of the Crane Co., and president and director of its subsidiaries, was president, Robert W. Hunt Co., Chicago, engineers, for six years before his election to head the Crane Co. He was a member of the American Society of Mechanical Engineers, American Society for Testing Materials, American Railway Engineering Association, and the Western Society of Engineers.

Among the Crane Company subsidiaries of which he served as president and director were Crane Co. of Mexico; Crane, Ltd., Montreal; Crane Export Corp.; Crane Enamelware Co.; Canadian Potteries, Ltd.; Warden-King, Ltd.; Trenton Batteries Co., Trenton, N. J.

MEETINGS

American Iron and Steel Institute. Annual meeting. Waldorf-Astoria, New York, N. Y., May 22.

American Management Association. Special Production Conference. Hotel Astor, New York, N. Y., May 21-22.

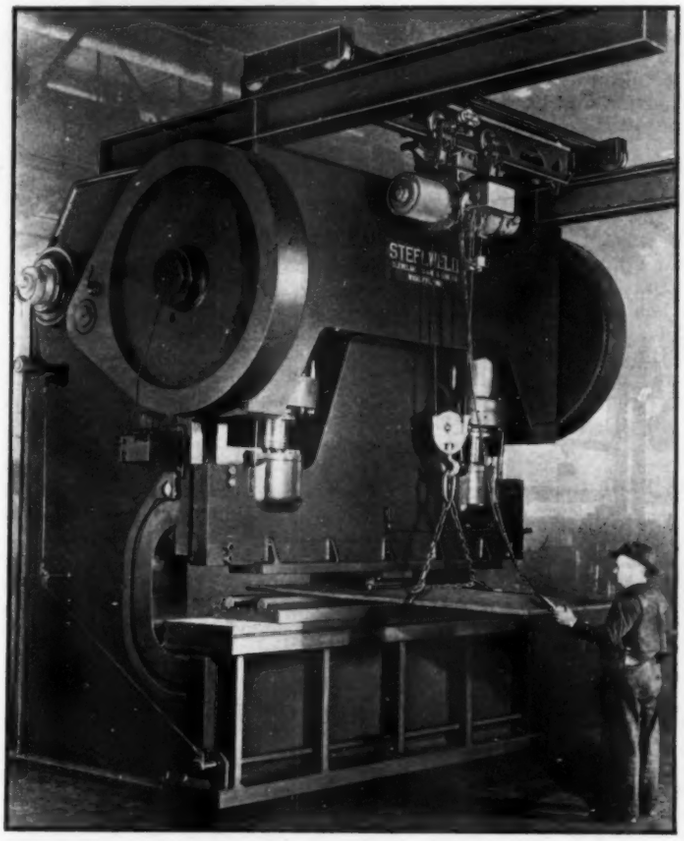
American Society of Mechanical Engineers. Semi-annual meeting. Kansas City, Mo., June 16-20.

American Society for Metals, Western Metal Congress and Exposition. Pan-Pacific Auditorium, Los Angeles, Cal., May 19-23.

American Society for Testing Materials. Annual meeting to be held in conjunction with an exhibit of testing apparatus at the Palmer House, Chicago, Ill., June 23-27.

Society of Automotive Engineers. Summer meeting. The Greenbrier, White Sulphur Springs, W. Va., June 1-6.

SHOP EQUIPMENT NEWS



Individual Overhead Cranes Built into "Steelweld" Presses

Steelweld Machinery Div., Cleveland Crane & Engineering Co., Wickliffe, Ohio, is equipping some of its larger "Steelweld" bending presses with individual overhead traveling cranes which make it easy for one operator to handle a heavy plate in and out of a machine as well as to support it during press oprations. The cranes, fabricated by the Cleveland Tramrail Div. of the company, are mounted on top of the machines with crane runways extending approximately 8 ft. in front.

The photograph shows the first press so equipped. It is one of a number being supplied for straightening armor plate in thicknesses up to 3 in. The crane bridge and carriage are hand propelled. The hoist is motor-driven and controlled by a pendant pushbutton station. The hoist is of 2-ton capacity and has a hoisting speed of 26 ft. per min. This press is also unusual in that it is provided with an especially wide bed top and ram bottom to accommodate wide dies necessary for armor-plate straightening. All shafting is located at the rear of the machine for safety.

25-in. Swing All-Geared Drilling Machine Developed by Sibley Machine & Foundry

The 25-in. swing all-geared drilling machine announced by Sibley Machine & Foundry Corp., South Bend, Ind., has been engineered and designed for efficient operation both in the toolroom and for production work. Precision accuracy as well as rugged design have been built into this drill press, permitting it to handle the finest toolroom and production work, as well as heavy, tough drilling jobs.

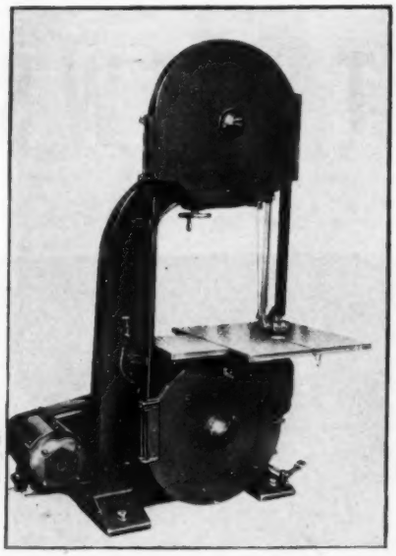
Instant changes of feeds and speeds are effected by levers within easy reach of the operator. Both levers are cam-operated. Spindle speeds range from 75 to 1,500 r.p.m. Feeds range from 0.005 to 0.045 in. The six-splined spindle can be operated either by power or hand feed; travel by power is 12 in. and by hand, 12½ in. It takes No. 4 and No. 5 Morse tapers. All controls are centered within easy reaching distance in front of the machine, enabling the operator efficiently to do frequent changeovers on job work and thus increase production.

The all-geared drive is obtained through a series of alloy steel heat-treated gears mounted on horizontal shafts. The transmission is totally inclosed, but is a complete removable unit with the transmission shafts mounted on anti-friction bearings. Multi-splined shafts are used throughout. All gears operate in an oil bath. Tapping operations are controlled by electrical reversing switches, operating through a starting lever.

This drill has a height over-all of 9 ft. 6 in. Maximum distance of spindle to the base is 33 in. The working surface of the table is 18½ x 24 in.

Special Tannewitz Bandsaw Cuts 30-In. Magnesium Blocks

Built by the Tannewitz Works, Grand Rapids, Mich., this special 36-in. bandsaw was designed especially for sawing magnesium blocks 30 in. thick. To accommodate work of this thickness, the



guide rises above the table more than 36 in. Similar machines built with special welded steel frames are available in any capacity up to those carrying 52-in. wheels. It is claimed that mounting the motor on a bracket at the side and driving through multiple V-belts provides an effective means of securing the proper saw blade speed for the specific material.

Upton Salt Bath Furnace Uses Unique Heating Principle

Based on an "Electrothermic-Permeation" principle, an improved type of internally heated electric salt bath furnace capable of producing more uniform heat, reducing fuel costs, and eliminating excessive spoilage of carburizing salts has been developed by Upton Electric Furnace Co., 2211 Grand River, Detroit, Mich.

Range of operation available with the furnaces includes virtually any heating operation requiring temperatures of 300 to 2,500 F. Furnaces are available for carburizing, cyaniding, hardening of molybdenum and tungsten high-speed steels, selective hardening, brazing, heating for forging, treating aluminum alloys, tool tipping, etc., in a range of sizes suitable for either batch or continuous operation.

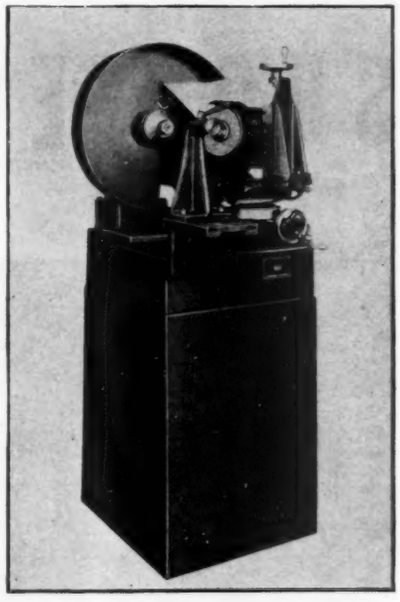
Advantages claimed for the improved design are: greater efficiency due to generation and distribution of heating throughout entire pot with larger percentage of heat developed at the bottom; elimination of "super-heated" spots to destroy chemical balance of bath; spacing of electrodes to prevent possibility of shorting and burning the work; and 20 per cent greater working area.

The "Electrothermic - Permeation" principle takes its name from the fact that heat for the bath is generated throughout all the effective working space rather than in a confined, separate heating area. Distribution of current flow for heating the salt is by unique patented arrangement of electrodes so that the greatest heat is at the bottom of the pot, with the balance decreasing in intensity as it approaches the surface of the liquid.

Rogers Rotary Knife Grinder Sharpens 20-In. Diameter Tools

Circular knives from 2 to 20 in. in diameter can be sharpened with the No. CC-33 grinder developed by S. C. Rogers & Co., 191 Dutton Ave., Buffalo, N. Y. Of rugged construction for long life, this machine is said to provide both accuracy and flexibility to enable it to handle a wide range of work.

A feature is the adjustable grinding head. This is originally mounted vertically on a heavy slide properly gibbed to take up wear and is vertically adjustable 1½ in. above and 1½ in. below the center of the work spindle. A heavy work spindle is provided which permits the use of cup wheel or straight grinding wheel up to 6x2 in. An additional feature is an attachment for mounting work between centers. This feature

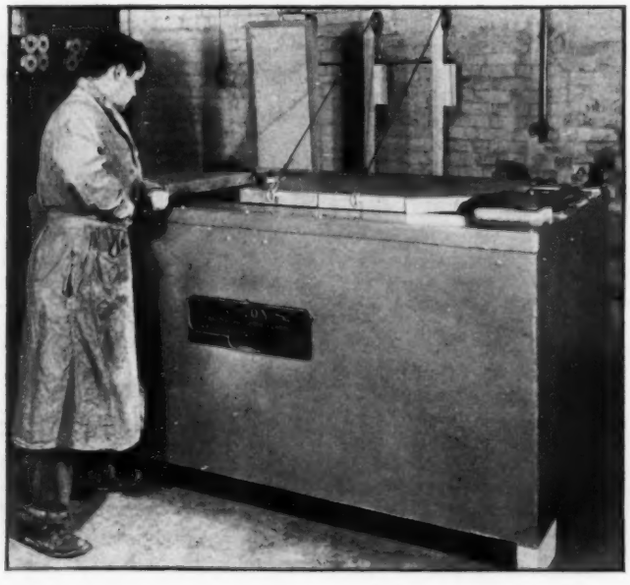


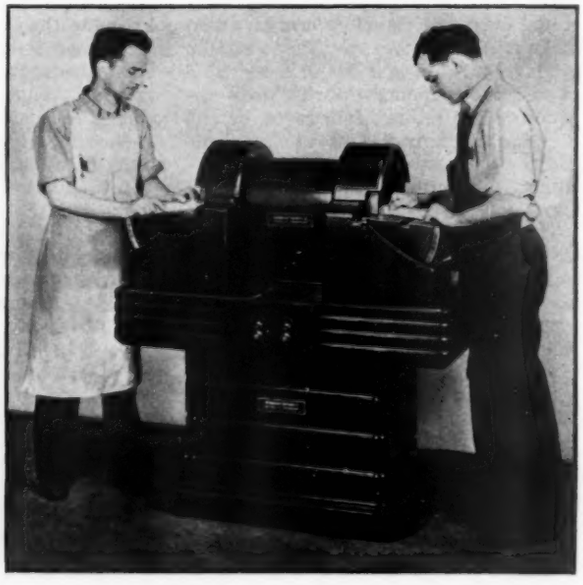
adds to the facility of the grinder and makes it applicable for a variety of grinding requirements.

Adjustments to meet all requirements for circular knife grinding are provided by three slides with handwheel screw controls. Each slide is fitted with adjustable steel gibs to take up wear. Swivel is graduated to insure correct grinding angle. The same angle is maintained without any change from wear of grinding wheel or change in size of knives.

14-In. Carbide Tool Grinder Made Available by Carboloy

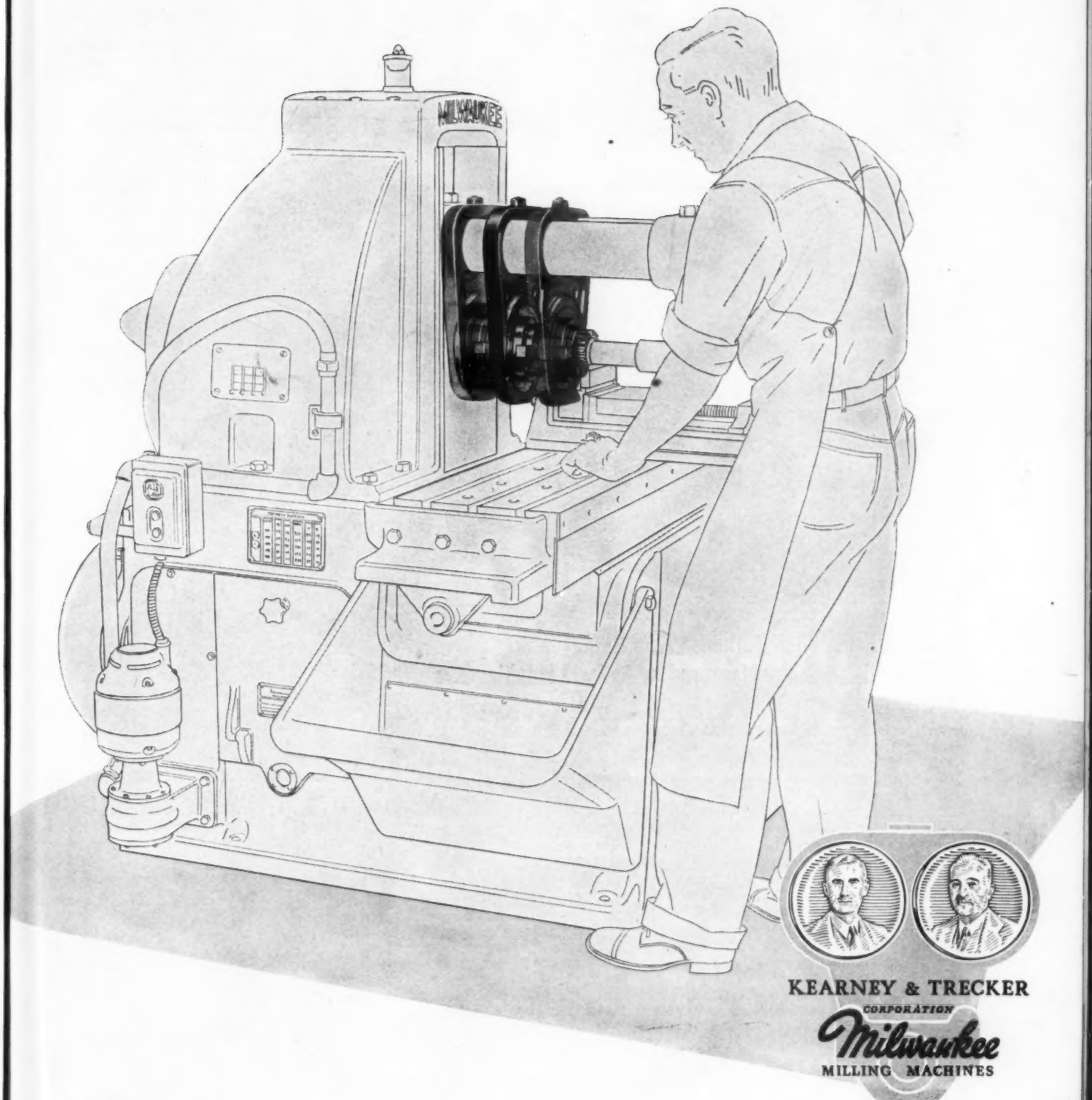
A larger carbide tool grinder of the double end type, designed so that two operators can grind tools simultaneously, has been announced by Carboloy Co., 11149 E. Eight Mile Rd., Detroit, Mich. This 14-in. machine is the largest in the Carboloy line. Its high capacity makes it particularly suitable for (1) plants where a large number of car-





The spindle construction of Milwaukee Bed Type Milling Machines gives these machines greater range without sacrificing rigidity — the quill has a full 7 inches cross adjustment, supported over the entire range. Every unit is designed for strength, compactness and sustained accuracy under heavy continuous service.

KEARNEY & TRECKER CORPORATION • Milwaukee, Wis., U. S. A.



KEARNEY & TRECKER
CORPORATION
Milwaukee
MILLING MACHINES

Milwaukee MILLING MACHINES

bide tools are being used or ground daily, (2) uses where large amounts of carbide removal are required, and (3) where heavy duty cemented carbide turning, boring, facing or planer tools, etc., are to be conditioned in addition to smaller tool sizes.

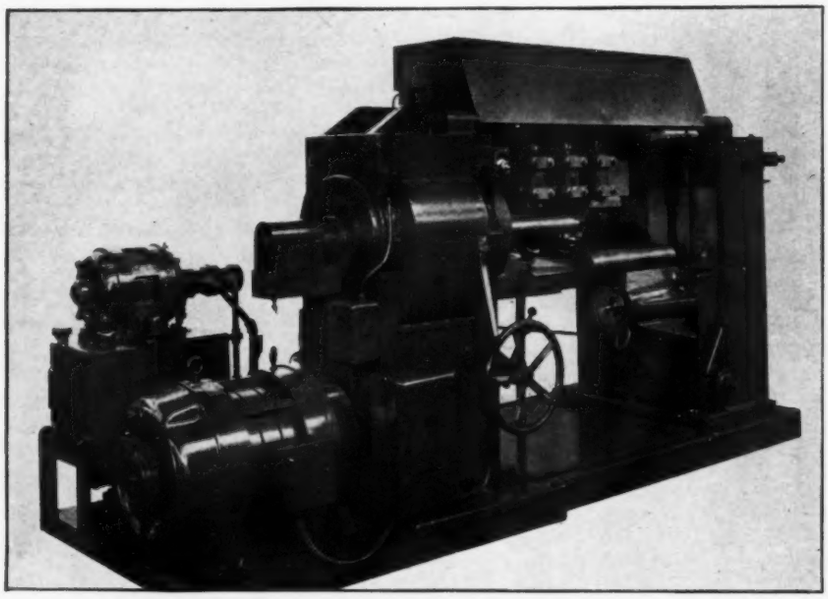
The grinder is designed for the use of two 14-in. disk wheels, one at each end. Each end also has its individually adjustable toolrest table. The grinder may thus be used, if desired, for rough and finish grinding, or for rough and semi-finish grinding before lapping.

To facilitate handling of large tools, toolrest tables are exceptionally large—9 x 22 in. They are individually adjustable by screws operated through detachable crank handles, graduations being provided on the side of the table to assure accurate setting. The toolrest tables can also be adjusted toward or away from the wheel through similar screws. Thus, the operator cannot accidentally push the table against the wheel by body pressure.

Wheel guards move with the table brackets. Suction spouts are provided for connection to individual or centralized suction systems. The table is so designed that special fixtures can be installed on the grinder.

Buttons for interlocking start, stop, and reversing switches are located on the front of the base, where they are easily accessible from either side. The 2-hp. fan cooled ball bearing motor mounted in the base is fully inclosed. Drive belt adjustment to the 1,350-r.p.m. spindle is made by positioning the motor hinge plate. The latter is accessible through a removable cover on the front of the base.

The spindle height is 42 in., weight is approximately 2,000 lb., while floor space required is only 49 x 26 in.



Special British Shell Turning Lathe Being Manufactured by Federal Machine & Welder

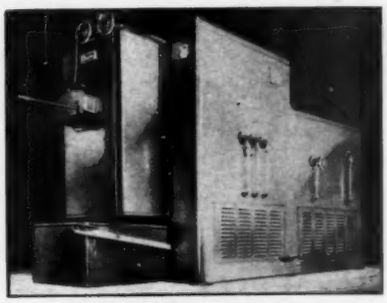
A special shell turning lathe of unique design is being offered to munitions manufacturers in America by Federal Machine & Welder Co., Warren, Ohio. This shell turning lathe is not a conventional machine tool but is a special lathe, designed to meet high production requirements in times of emergency.

The design was completely engineered by Britannia Machine Tool Co., Ltd., London, England, prior to the beginning of the war in order to have a machine available which would meet the conditions with which that country is now faced—that of turning out shells in large quantities with unskilled help. To do its share in the present emergency, Federal Machine & Welder has made arrangements with Britannia Machine Tool to take over the design of this lathe and manufacture it in the United States.

Many new features are embodied in the design of this lathe. The tool boxes are supported from an overhead bridge to permit chips to fall clear. A conveyor loads and unloads the shell without being lifted by the operator. Production on this machine for large shell is extremely high, as from eighteen to twenty British 5½-in. shell, 27 in. long, can be rough turned per hour without fatigue by unskilled operators.

"Lithco" Atmosphere Furnace Prevents Carbon Content Change

Steels of different carbon analyses can be heated simultaneously without changes in surface carbon content with the Model HU812-4 "Lithco" atmosphere furnace developed by the Lithium Corp., Raymond-Commerce Bldg., Newark, N.J. It is claimed that nitriding and hydrogen embrittlement are eliminated, and that air cooling without scaling is possible.



Use of a specially developed compound is said to provide a furnace atmosphere which provides an excess of the neutralizing element. Thus any oxygen released from water vapors, air, carbon dioxide, carbon monoxide, oxides of nitrogen, or absorbed gases, is absorbed by this neutralizer. A carrier gas, generated within the furnace, entrains the vapor which evolves continuously from a cartridge refill and bathes the work being heated in this neutralized atmosphere. Any danger from injurious and highly explosive gases is completely eliminated. Features of the furnace illustrated include a pedal operated ball bearing equipped ratchet stop, self-locking door; 13½ in. insulated walls, and special venting tubes for recirculation. Specifications: dimensions, 65x38x85 in.; temperature range, 1200–1800 F.; weight, 4,250 lb.

Pacific Offset Boring Head Eliminates Micrometer Screws

No highly stressed fine micrometer screws are used in the offset boring head developed by Pacific Specialty Supply Co., 344 N. Vermont Ave., Los Angeles, Calif. Instead, two hardened buttons are checked with a micrometer before the required hole is bored.

In this method of adjustment, one button is attached to the stationary and the other to the adjustable part of the boring head. One button has a flat side, while the other is completely round. By checking across these two buttons with a micrometer, a reliable reading is obtained which will eliminate any chance for costly errors.

Boring capacity of the head is 0–15 in. Boring bar hole size is 1 in. Outside diameter of the boring head is $4\frac{7}{8}$ in. and the over-all length without shank is $3\frac{1}{2}$ in. Several types of standard straight and tapered shanks are made.

HELP KEEP PRODUCTION "on the job"

... with

SUNOCO
EMULSIFYING CUTTING OIL

DEEP CUTS WITH HIGH SURFACE SPEEDS!

PERFORMANCE DATA
OPERATION—Turning forged spindle.
MACHINE—Monarch 16" model "W" engine lathe.
MATERIAL—S. A. E. 2350 steel.
CUTTING SPEED—250 S. F. P. M.
DEPTH OF CUT—3/16 inch.
FEED—.017 inch.
TYPE OF TOOL—Cemented Carbide.
CUTTING LUBRICANT—1 part Sunoco to 10 parts water.
Courtesy of THE MONARCH MACHINE TOOL CO.

Greater production . . . without sacrificing accuracy and finish! This is the challenge the overburdened machine-tool must meet to accomplish our national defense program.

The place to meet this requirement is at the edge of the cutting tool with the right cutting lubricant to reduce friction and dissipate heat. And that's where the high lubricating and heat absorbing qualities of Sunoco Emulsifying Cutting Oil can really help you and your machines answer production demands.

Turning, milling or drilling—Sunoco permits the rapid removal of metal and maintenance of close tolerances . . . with decreased "down-time" for tool re-grinding and resetting. That's why we urge you to test Sunoco on results alone. Write today for full information.

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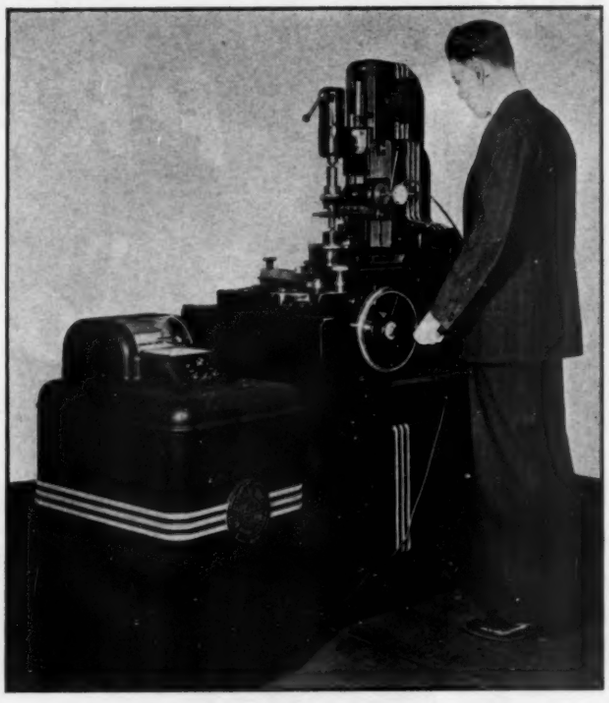


"Polymatic" High-Speed Precision Screw Machine Produces Accurate Parts From Small Stock

Accurate parts from stock as small as fine wire can be rapidly produced with the No. 11 "Polymatic" high speed screw machine, developed by Unit Machinery Co., Rockford, Ill. Said to be exceptionally easy to operate, this machine features a wide speed range to cover the requirements for cutting such a variety of materials as stainless steel, tool steel, brass and plastics. An outstanding improvement is an ingenious device known as the pick-up slide attachment which produces cut-off pieces without burr and separates the parts from the chips. The base is of heavy ribbed cast iron. It contains the drive motor mounted on an adjustable platform, the coolant pump and tank, the electrical equipment, and the spare change gears. The lubricating oil reservoir in the upper portion of the base is equipped with a visible oil gage. Ample room is provided for chips, which can be removed easily through large openings.

Spindle drive gear is located between the front and rear bearings for permanent alignment. Gears are of heat-treated alloy steel, cross shaved and lapped for quiet, back-lash free operation at high speed. The front spindle bearing is of the staggered double roller type. Provision is made for adjusting the radial clearance between the rollers and outer race. Front bearing is placed exceptionally close to the spindle nose. Rear bearings are of the preloaded fine precision ball thrust type. The spindle contains a standard push-out type collet and feed finger mounted in a feed tube. Chucking pressure on the collet is adjustable and is transmitted through a pressure limiting overload device.

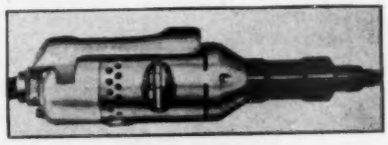
All control is effected by levers conveniently grouped on the machine head. All feed movements are controlled from a common camshaft for automatic operation. Feed of this camshaft is variable by means of pick-off gears giving a range of 1 revolution in ¾ to 24 sec. according to the time required to make one part. Front and rear cross slides are operated by individual plate cams. Each cross slide is individually adjusted. A tool slide may be equipped for any one end operation. Stock feed mechanism, as well as all other high-speed parts, is lubricated automatically.

Portable Gear Checking Recorder Developed by Michigan Tool

A development in gear checking equipment by which chart records of involute form and lead can be obtained from gear checkers of the indicating type has been announced by Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich. This recorder, operating on a new electrical principle for gear recording devices, can be coupled to any Michigan "Sine-Line" lead checker or involute checker for gears or hobs by simple changes to provide for the required electrical connections. It operates on standard 110-volt a.c. It is also adaptable to use with other makes of checking equipment.

Operation is based on the use of synchronous devices, one located in the recorder and one installed on a bracket in the base of the gear checker. Any motion imparted to one of them is accurately duplicated in the other. The synchronous device in the gear checker is connected directly to the sine bar table. The device in the recorder is connected to the chart drive.

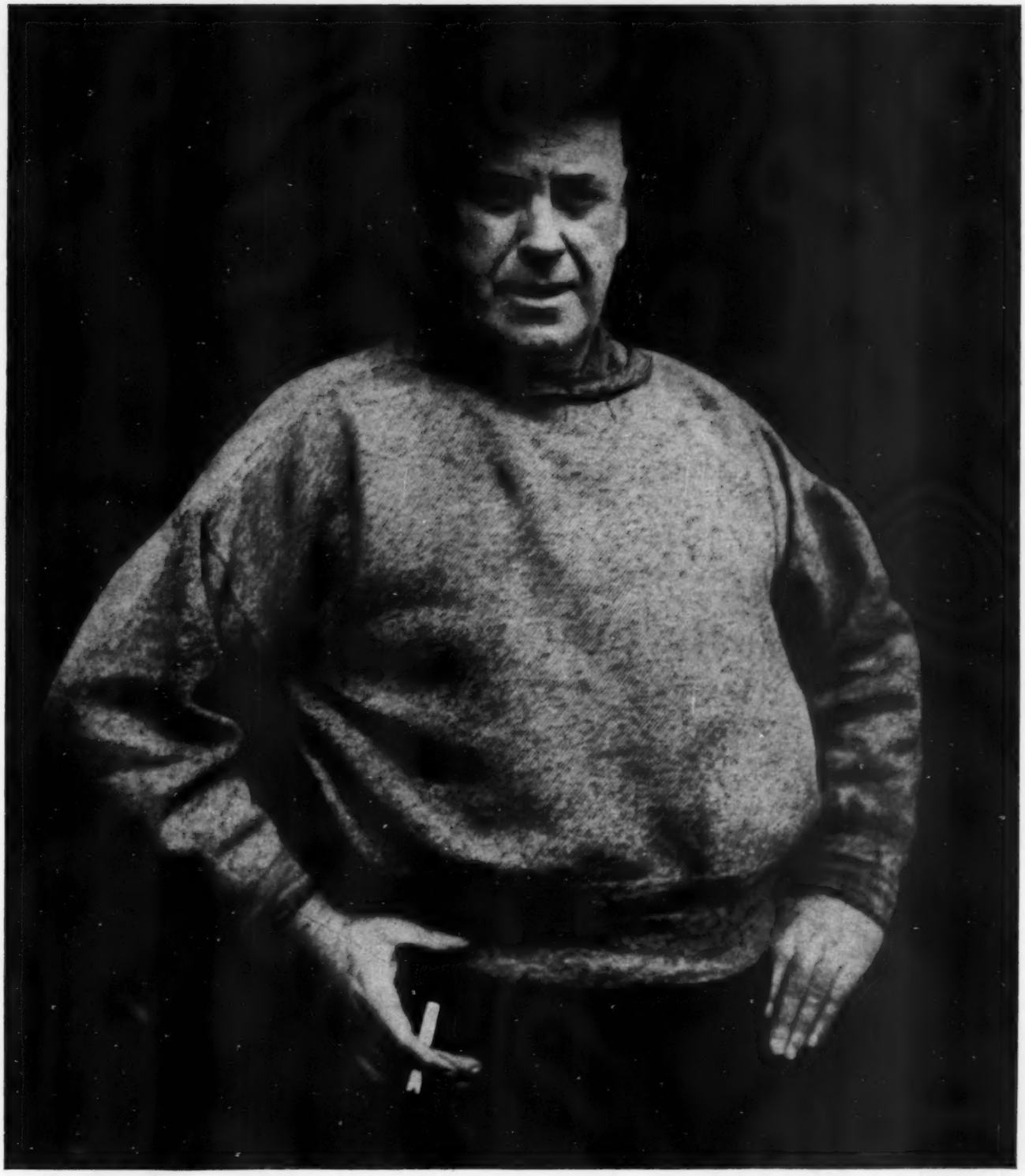
A second electrical connection between the checker and the recorder actuates the cross movement of the recording pen in relation to movement of an indicator mounted on the gear checker. This indicator replaces the conventional indicator by merely removing two screws and attaching the new unit. Movement of the electrical indicator pen on the chart is magnified several times between the indicator and the recorder. Vertical graduations on the recorder chart are in ten-thousandths of an inch, while horizontally, one inch is equivalent to 4 deg.



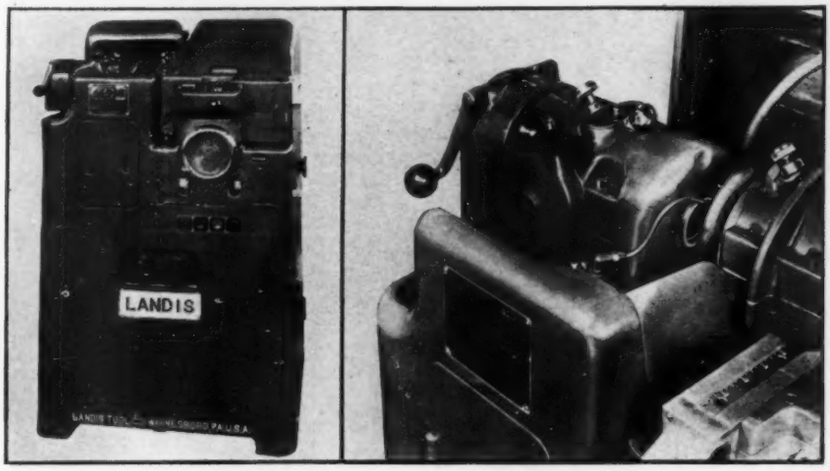
Center-Drive "Scrugun" Offered by Van Dorn

Van Dorn Electric Tool Co., Towson, Md., has developed the No. 8 center-drive "Scrugun" especially for operation in a suspended position. Its center spindle improves aim, the bonnet grip or paddle switch arrangement eliminates handles, and it operates in reverse at full power when equipped with reversing switch. It is available with either positive or adjustable clutch, and with either bonnet grip and toggle switch or paddle switch.

The tool drives wood screws up to No. 10x2 in., self-tapping screws up to No. 12, and machine screws and nuts up to ¼ in. diameter. The no-load speed is 750 r.p.m.; optional speeds available at no extra charge are 500, 1000, and 1250 r.p.m.



THE "FEEL" OF BRASS. Brass isn't just a matter of pyrometers and chemical analyses. It's also a matter of men like Tom Carroll. For over 35 years, Tom has been casting brass for Revere Copper and Brass Incorporated. Today, he and thousands of other Revere workers like him stand behind defense orders, as they always have stood behind Revere metals. They furnish the *human touch* in fabricating copper, brass, bronze, and other copper-base alloys. In fostering this *human touch*—as well as research and plant modernization—during the depression years, Revere has been well able, in the present emergency, to meet the nation's defense needs. Just as in the brighter times coming, Revere will meet the demands of a new vitalized American industry. Revere Copper and Brass Incorporated, 230 Park Avenue, New York.



Improved Landis "Race-A-Way" Grinder Aids in Producing Small Ball Bearing Races

Several improvements have been made in the No. 1 "Race-A-Way" grinder intended for producing smaller size ball bearing races up to and including the No. 204. This machine, built by Landis Tool Co., Waynesboro, Pa., is equipped with a "Landis-Solex" sizing device which in combination with an electric timing device permits the performance of three operations during the same grinding cycle. The race is rough ground up to the point where only a small amount of stock is yet to be removed. Grinding continues, but at a slower grinding feed which is equivalent to what would ordinarily be the finishing operation. With the work practically to size, grinding feed and work head oscillation stop. The work head is centered and for a fixed but exceedingly brief period of time the wheel sparks out until the work is down to exact size.

The entire grinding cycle is automatic. Wheel spindle operates at 50,000 r.p.m. The spindle, an exclusive Landis design, utilizes super-precision ball bearings and will stand up for long periods under severe duty. In the event that the machine is intended to grind only the larger races having ⅞-in. groove diameter and up, a 30,000-rpm. spindle is supplied. Coolant flow may be automatically stopped during the finishing portion of the cut, resumed as the wheel backs away from the work and then stopped again at the end of the cycle. A large master safety button when depressed stops every machine movement instantaneously. A hydraulic wheel reset mechanism causes the wheel base to reset itself automatically at the end of each grinding cycle, the amount of reset being adjustable and being equal to the amount of stock which is removed from each race. Hydraulic power is used to move base into and out of grinding position.

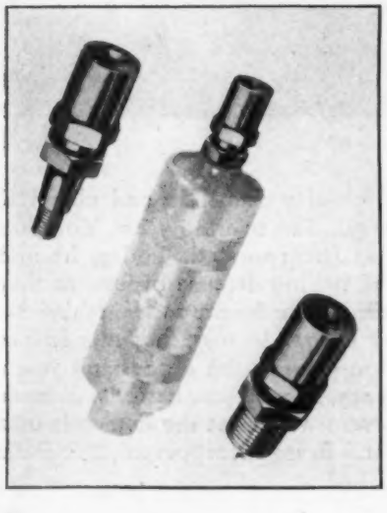
Net weight, including electrical equipment, is 3,500 lb. The floor space required is 35 x 41 in. There are four electric motors in all. They are of the constant speed type, the work drive motor being ¼ hp., 1,750 r.p.m.; the wheel drive motor 2 hp., 3,600 r.p.m.; the oscillating drive motor, ⅓ hp., and the pump drive motor, 1 hp., 1,200 r.p.m.

Motch & Merryweather Grinder Sharpens Segmental Saw Blades

Motch & Merryweather Machinery Co., Cleveland, Ohio, has developed the No. 1 automatic saw grinder for sharpening the segmental saw blades used in conjunction with its Nos. 3 and 4 hydraulic cold sawing machines. Automatic indexing and rigid construction are claimed to assure rapid, accurate sharpening.

The drive, obtained by a single electric motor through belts, is completely inclosed and protected against dust. An oil pump provides lubricant to all internal moving parts. The wheel spindle and wheel slide are located in the same plane, eliminating overhang and minimizing vibration. Accurate pitch is effected by an indexing disk. Fast speeds for fine pitches and small-diameter saws and slow speeds for larger saws are accomplished through sliding gears. Alternate high and low teeth can be ground in one setting by positioning a lever on the left-hand side of the machine. All operating controls can be actuated while the grinder is running.

The saw blades are segmental in type, promoting greater production and long life, with lower cutting cost. The tooth pitch can be suited to any material, contributing to speed and accuracy. Segments of high-grade tool steel are fitted to a heat-treated center. They project slightly to protect the body of the blade from rubbing. The teeth are ground to a special form to afford the most favorable cutting conditions. The segments form a closed ring which stiffens the blade and lends additional strength. After the segmental teeth are completely worn, the main blade can be re-set with new segments without any reduction in diameter. The segments are machined to gage and can be readily exchanged.



Precision Collet Chuck Fits Flexible Shaft Machines

A compact, single-purpose collet chuck which can be attached quickly to hand-pieces used on Stow flexible shaft machines has been brought out by Stow Mfg. Co., Binghamton, N. Y. The unit is furnished in two sizes, one with ¼ in. and the other with ⅜ in. chucking capacity.

The attachment is made in two styles. With the straight-threaded, hex-head stud, the collet chuck interchanges with the clamp spindle on the standard hand-piece. With the tapered shank it fits into the tapered socket of the high-speed hand-piece, a type used with rotary files, mounted points or other high-speed tools, to assure true running on precision work.

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THE RECOGNIZED SYMBOL OF *Precision*

There's only one standard at Ex-Cell-O . . . the making of the finest precision machines and tools that the most highly trained engineers and craftsmen can produce. This is why the Ex-Cell-O symbol—whether on a large machine like a thread grinder or on a small cutting tool like a counterbore—is positive assurance of a precision built product to do a real precision job.

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● *Ex-Cell-O produces* **THREAD GRINDING, BORING and LAPPING MACHINES, CARBIDE TOOL GRINDERS, GRINDING SPINDLES, HYDRAULIC POWER UNITS, BROACHES, CUTTING TOOLS, DRILL JIG BUSHINGS** *(Ex-Cell-O Automatic Thread Grinder No. 33 —one of eight styles—shown to right).*

EX-CELL-O CORPORATION
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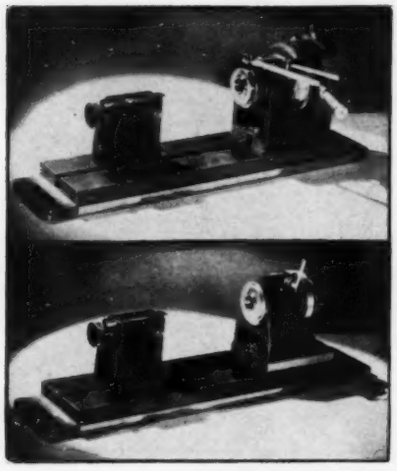


Hardinge Collet Index Fixtures Used in Shop or Toolroom

Suitable for either production or toolroom use, a new line of collet index fixtures has been introduced by Hardinge Bros., Elmira, N. Y. The fixtures have been designed for wide interchangeability to provide for a great variety of applications.

The type H-4 horizontal collet index fixture illustrated was designed particularly for use in toolroom and inspection departments. The spindle takes 1-in. collets and has a hardened and ground index plate with 24 holes. It is provided with removable keys for parallel or for right angle fitting to sub-base or machine table. The spindle is hardened and ground.

The No. HV-4 horizontal vertical collet index fixture is designed particularly for use in production departments. It incorporates all the features of the H-4 fixture, plus (1) hardened and ground index plate with a preselecting arrangement, (2) collet closer with a 100:1 leverage to facilitate rapid chucking of work on a production basis, (3) ratchet device for rapidly rotating the spindle when indexing, and (4) base for operation in either a horizontal or vertical position.

The SB-4 sub-base illustrated is 24½ in. long and 5⅛ in. wide, with a 21¼x4⅞ in. surface for fixtures and tailstock. Maximum center distance is 11 in. with the H-4 fixture and T4 tailstock illustrated, 10 in. with the HV-4 fixture and T-4 tailstock, and 13 in. with two T-4 tailstocks. Height of sub-base is 1½ in. Tailstock center height is 4 in.

"Hercules" Type Holder Built for Heavy Duty

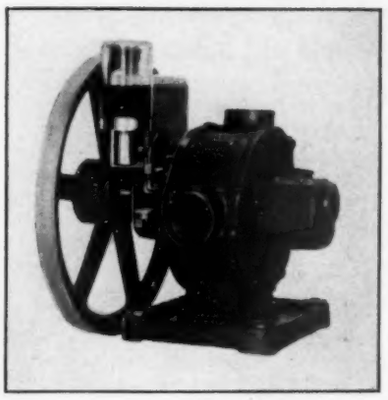
For faster numbering with a tool which will withstand continuous hammer blows sufficient to stamp steel parts and castings, the hand style heavy duty "Hercules" type holder has been developed by Acromark Corp., 245 N. Broad St., Elizabeth, N. J. It is made entirely of a selected shock-resisting tool steel with the head drawn to prevent peening and dangerous mushrooming. The thumb clip that holds the type is made of steel formed to shape, holding the type by its oversize shoulder.

The steel type is made of a shock-resisting tool steel that takes an excellent hardness and retains its face. Each character is machine engraved by three dimensional engraving equipment and carefully hand finished and hardened by controlled methods. The extra body to the type not only gives it a shoulder for holding in position and insuring foolproof assembly but gives extra strength where needed.

Concentrated Light Delivered By Birdseye "Floodlite" Lamp

Wabash Appliance Corp., 335 Carroll St., Brooklyn, N. Y., has developed a Birdseye "Floodlite" for general lighting purposes which delivers a concentrated flood of light in a medium beam which is said to be especially effective in applications requiring intense illumination for exacting work. The "Floodlite" is essentially an incandescent filament bulb with a lining of pure silver sealed inside to form a reflecting surface that cannot be dulled or tarnished by dust or fumes.

For localized lighting to supplement general illumination, a detachable swivel socket focuses the light exactly where needed. The light is made in four sizes and four separate voltages, from 100 to 300 watts, and 110 to 125 volts.



Leiman Metering Lubricator Provides Positive Lubrication

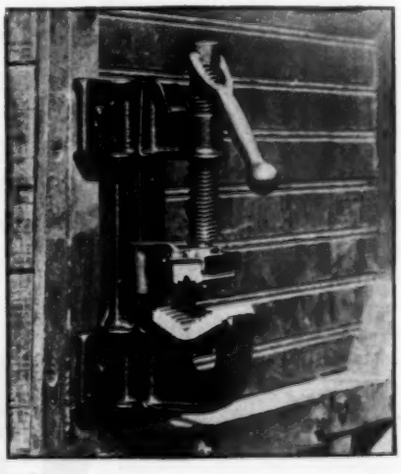
Leiman Bros., Inc., 101-EE-7 Christie St., Newark, N.J., has developed an automatic mechanical metering lubricator which delivers oil according to the speed of the machine. Thus when the machine stops the oil ceases to flow.

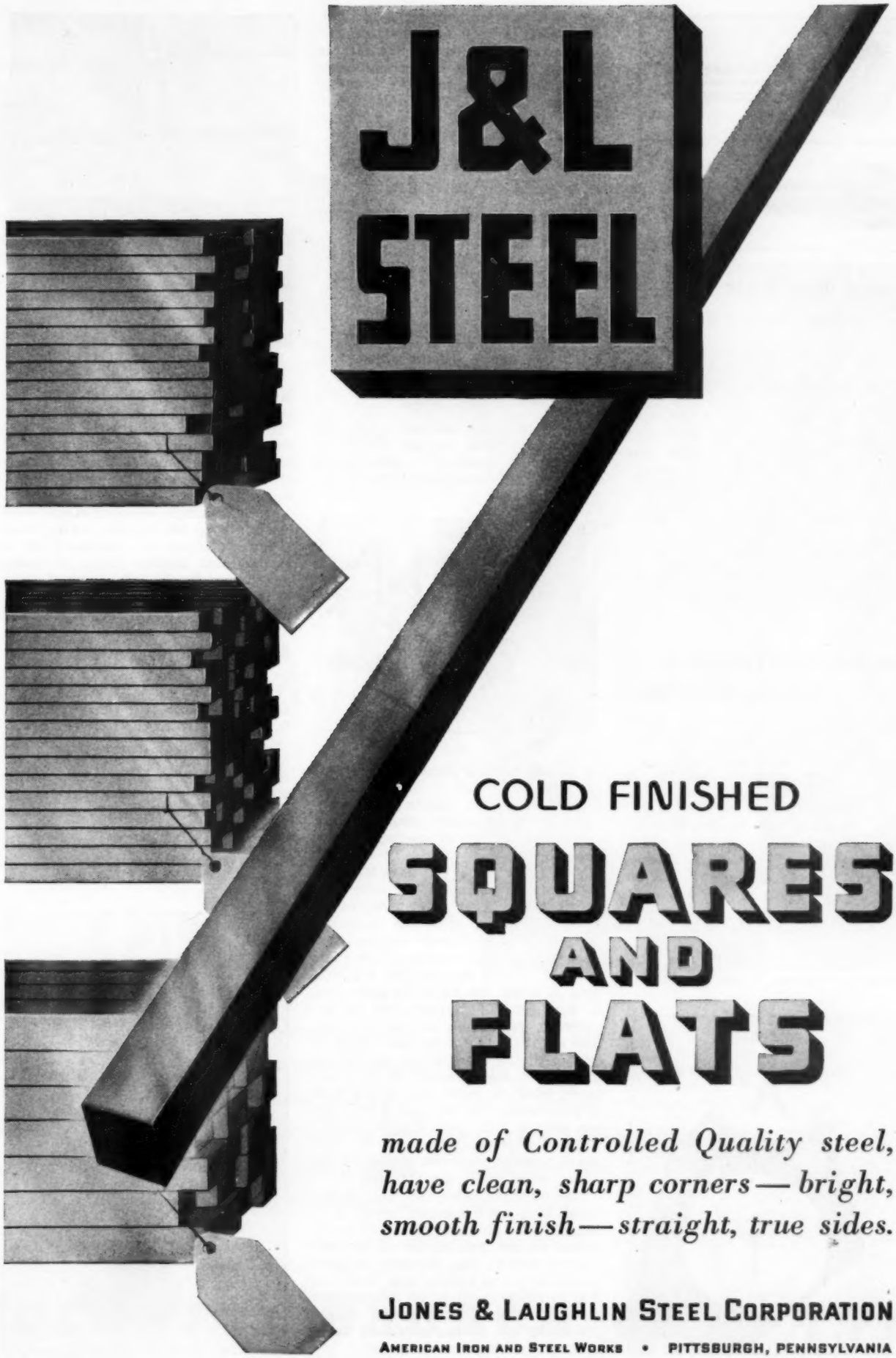
The device can be set to handle any feed from one drop in ten minutes to ten drops in one minute. It does not rely on gravity feed for the oil to reach the surface requiring lubrication. The lubricator is equipped with a visible oil reservoir. It is designed to handle light, heavy or medium viscosity oils.

Open Side Pipe Vise Mounts on Bench or Truck

Armstrong Mfg. Co., Bridgeport, Conn., has devised the No. 222 open side pipe vise for installation on a bench or side of a service truck. This unit has broad jaws, a frictionless disk, quick-acting screw, and a handy swinging handle. It takes pipe from ⅛ to 2 in. in diameter.

The company also has announced that hinged vises have been redesigned in three ranges: No. 232 for ⅛ to 2-in. pipe; No. 233 for ⅛ to 2½-in. pipe, and No. 234 for ⅛ to 3½-in. pipe. They also have the double-quick screw, frictionless disk, and one-piece slide.





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made of Controlled Quality steel, have clean, sharp corners — bright, smooth finish — straight, true sides.

JONES & LAUGHLIN STEEL CORPORATION

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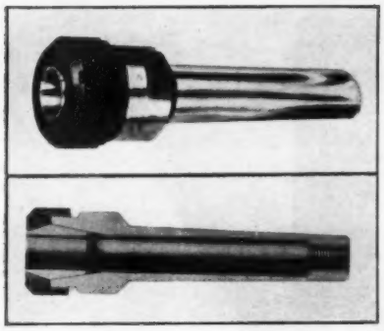


Universal Collet Chucks Feature Improved Nut Design

As an additional improvement to its line of collet chucks, Universal Engineering Co., Frankenmuth, Mich., has announced a new type nut in the three larger collet chuck sizes (Z, ZZ, and XZ) which reduces locking effort by 50 percent. Whereas the former nut construction tightened directly against the collet, the new design tightens against a floating sleeve. This method greatly reduces friction and makes locking easier and more positive. The outward appearance of the nut is also changed. It now is jet black, rustproof, and fluted for tightening with a spanner wrench.

Coats Centrifugal Tachometers Have Five Speed Ranges

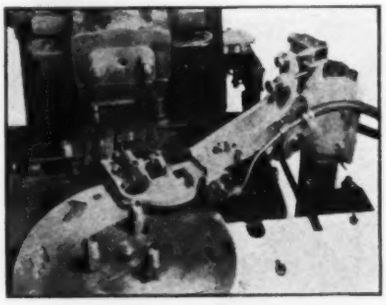
Five speed ranges, selected by a rotating type gear shift, are available with the centrifugal hand tachometers offered by Coats Machine Tool Co., 75 West St., New York, N. Y. Made in three models for the ranges of 30–12,000, 45–18,000, and 60–24,000 r.p.m., these instruments employ hands which make only one revolution of the dial.

Gears are not moved toward or away from each other as in a thumb-slide gear shift. Rather, the gears remain constantly in mesh, avoiding shock stresses when shifts are made. The rotary gear shift also results in a shorter instrument which is easier to hold. Designed for both right and left hand rotation, these tachometers indicate instantaneous speed fluctuations and are unaffected by magnetic or electrical influences, moisture or temperature changes. The knife edge pointer is equipped with a damping mechanism to make it "dead beat."

Heyman Press-Feeding Device Provides Operator Protection

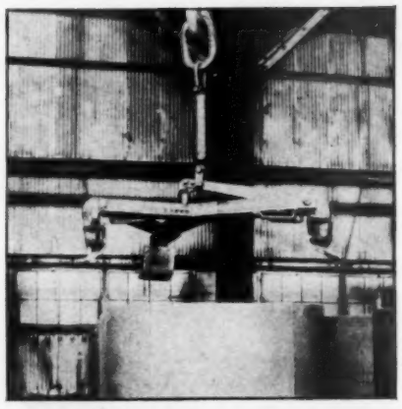
Complete safety for press operators is claimed to be provided with the semi-automatic press feeding device developed by Heyman Mfg. Co., 157 Chambers St., New York, N. Y. Especially suitable for runs between 3,000 and 500,000 pieces, this device feeds blanks to a forming or drawing die. It is operated by a separate electric motor, its speed setting the pace for the operator.

A feature of the machine is that the dial is away from the die and never goes under it. Special dies, gage plates and slides are unnecessary. The transfer arm places the blank accurately on the die. Two types of arms are furnished—a vacuum and a mechanical pick-up arm. Both are adaptable to a very wide variety of operations and parts.



The operator does not have to watch the "point of operation." In correcting a common danger an added safety feature is built into this machine. Ordinarily, if two blanks are deposited upon the die, or if a stamped piece has not been ejected and another is placed upon it, either the die or the press may be damaged. To prevent such an occurrence, the arm is hinged near the post and held in the set position by a spring. In the event of an obstruction the arm cannot descend its full distance, with the result that it will tend to pivot about the pin and make contact with it; this opens the circuit and stops the press. When all is clear again, pressing the reset button on the limit switch resets the machine.

The indexing table (or dial) is rotated at a predetermined speed by a separate electric motor. The dial is not jerked around, but indexes at an even rate of speed. The machine is controlled by a foot switch; this keeps the dial in either constant or intermittent rotation. Tripping of the press is controlled by the feeding machine, being accomplished by means of a cam.



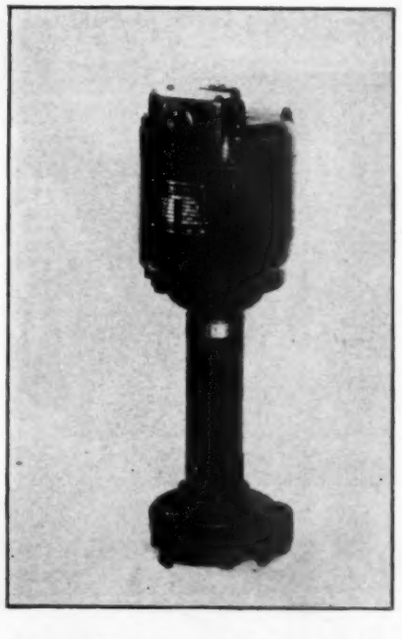
Heppenstall "Safe-T-Tongs" Automatically Grab Hot Covers

Heppenstall Co., Pittsburgh, Pa., has developed a new type of automatic "Safe-T-Tongs" for a large steel mill to lift annealing covers from stacks of steel coils. Made of forged nickel-chromium-molybdenum steel, corresponding to S.A.E. 4340, heat-treated to provide ample strength along with toughness to resist shock loads, these tongs eliminate the necessity of a ground man placing chains or hooks on the extremely hot covers. Lifting capacities run as high as 200,000 lb.

B. & S. Centrifugal Pumps Designed With Small Base

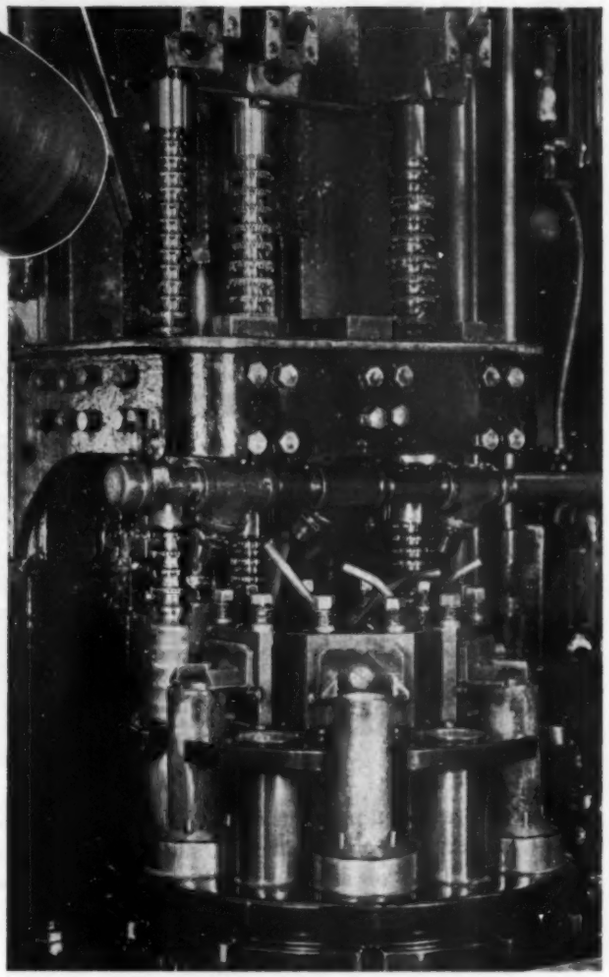
Brown & Sharpe Mfg. Co., Providence, R. I., has designed the No. 206A motor-driven centrifugal pump with a small diameter base so that it can be mounted in small, narrow tanks or in other places where space is limited. This pump has a depth of submergence of less than 10 in.

The pump is fitted with grease-sealed ball bearings, and stainless steel shaft is integral with motor. It is hydrauli-



THE JOB: Broaching 26 to 38 internal splines in large scale production to accuracies insuring a slip fit with zero backlash.

THE TOOLS: 3 Colonial hardened and precision ground broaches. 1 for finishing the bore; 1 for roughing the splines; 1 for finishing the splines.



Perhaps

You Don't Need

ZERO BACKLASH SPLINES

. . . . . as Universal Products Company did for the sliding splined ends of the propeller shafts it makes for passenger cars, trucks and other automotive vehicles. Minimum backlash and long life had to be maintained in the severe service to which universal joints are subjected.

Where production of varied sizes in fairly large quantities with the utmost in accuracy is required, you too will find that Colonial Broaches —hardened and precision ground—will provide the best answer on any job where broaching can be used.

Further details are in the current issue of "Broaching News".
Are you on the mailing list? No obligation. Just drop us a line.

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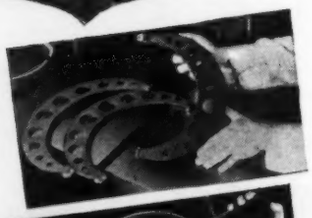
ONE FORTY SEVEN JOSEPH CAMPAU • DETROIT, MICHIGAN

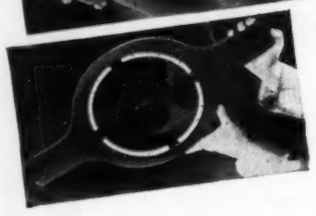
GREATEST TIME-SAVER IN DEFENSE WORK

The sensational savings in time effected in metal working plants equipped with one or more DoAlls are easy to figure, but there are other savings, too intrinsic in value to measure — savings of energy, temper, and mental fag, when rush jobs at last move through in one-half to one-quarter the former time.

Model V-36 with 36" throat handles large and odd-shaped parts at Northwest Airlines, St. Paul.



MICROMETER
These special frames sawed in 45 minutes at Northwest Airlines.



PROPELLER WRENCH
At Northwest Airlines. Inside cut, 15 minutes. Outside cut, 30 minutes.

DO IT WITH A **DoAll**

Speed up production—cut corners—turn out better work. Wherever metal is shaped, cut and used, the DoAll is an equipment "must". Takes the place of shaping, milling and lathe work on hundreds of jobs.

Let us send a factory-trained man to your plant with a DoAll to show you what this remarkable machine tool can do for you.

Band Filer

Does faster, better, smoother continuous filing on all materials from high-carbon steel to brass, wood, etc. Your choice of 23 styles of file bands, ½", ⅜" and ¼" wide, flat, oval or half round. DoAll Band Files are remarkably efficient —5 times as fast as jig filing.

DoAll Grinder

A super precision surface grinder—a real production tool. Less vibration because motor is built right on ball-bearing spindle. Work table has exceptionally large bearing surface. Hydraulic table travel is infinitely variable, up to 50 f.p.m.

FREE-Literature and Technical Data on Contour Machining

CONTINENTAL MACHINES, INC.

1310 S. Washington Ave. Minneapolis, Minn.

Associated with the DoAll Co., DesPlaines, Ill., Manufacturers of Band Saws and Band Files for DoAll Contour Machines.

cally balanced and has an aluminum bronze impeller which is designed to allow abrasives to be discharged without excessive wear within the housing. The motor is totally inclosed, giving more protection against entrance of dust and vapor.

Pump is furnished with a ¼-hp. motor and is powered to handle liquids up to 1000 s.s.u. At 1725 r.p.m. and pumping water the discharge varies from 20.5 gal. per min. at 5 ft. total head to 8.5 gal. per min. at 11 ft. total head. Delivery when handling oil is slightly reduced.

"Lite-Line" Fluorescent Units Offered by Benjamin Electric

A fluorescent lighting system to provide more light at lower cost, known as the "Lite-Line" system, has been announced by Benjamin Electric Mfg. Co., Des Plaines, Ill. Unbroken lines of light, row on row across the entire ceiling, can provide higher levels of illumination for both plant and office in an efficient and practical manner.

Significant features of the system are: (1) long, continuous light sources which conform to modern architectural trends, (2) increased illumination to provide 35 to 100 foot-candles on working planes without involving changes in existing wiring, and (3) greater flexibility and economies of the sectional assembly principle. Units utilize the 48-in. Mazda fluorescent lamps and are available in single and double reflector lengths.

Cartridge Type Thermostat Made Available by Ulanet

George Ulanet Co., 89 E. Kinney St., Newark, N. J., has developed the "Pilotherm" cartridge type thermostat for convenient mounting in any desired location. Included is a snap switch and box, pilot light and thermostat element, completely assembled and wired, ready for installation.

The thermostat unit, which is available for maximum operating temperatures of 300, 450 and 700 F., is provided with three feet of asbestos covered nickel stranded wire leading to the switch box. Three feet of nickel wire for connection to the heater terminal and six feet of rubber cord for handling 500 watts are also provided. The unit is suitable for use on hot plates, hot tables, melting pots, molding presses and other electrically heated equipment.

Solenoid-Operated Valves Built for Hydraulic Control

Solenoid-operated valves made by Vickers, Inc., 1400 Oakman Blvd., Detroit, Mich., are available for electric-hydraulic control applications. Three general types are produced: standard threaded pipe connection models, flange pipe connection models, and a

Immediate Shipment

On DoAll Contour Machines

Because our manufacturing facilities were increased 400% early in 1940, before the defense program started.

Because we use arc welded construction for greater speed, and have developed a process of attaching pads that have machined surfaces, which eliminates handling and machining heavy framework.

Every 40 minutes we take a DoAll off our 1,000-foot assembly line.

Like Detroit's auto plants—DoAlls are built as fast as needed—giving you higher value.

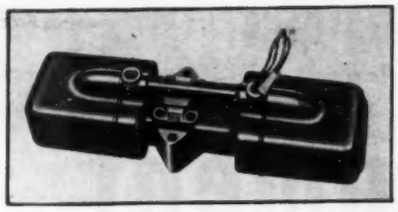
Now recognized as the indispensable machine tool, this new shape-cutting process has revolutionized machine shop practice throughout the world.

Again the progressiveness and foresight of the DoAll Organization is demonstrated in making immediate shipment to aid American industry in meeting today's demand for greater and faster production.

NO MACHINE TOOL "BOTTLENECK" HERE

CONTINENTAL MACHINES, INC., MINNEAPOLIS, MINN.

Associated with the DoAll Co., Desplaines, Ill., Manufacturers of Band Saws and Band Files for DoAll Contour Machines



gasket mounted design. Sizes range from ¼ to 3-in. standard pipe sizes.

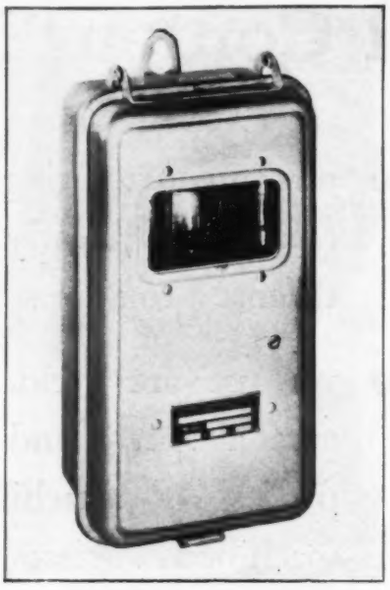
Solenoids on these valves are protected from dirt and damage from carelessness or improper handling by covers which also provide an improved appearance. Design is such that by taking out two cap screws, the cover can be removed to inspect the solenoids without disturbing the wiring. Conduit connection for the wires is made in the base casting to which the solenoid covers are attached. On valves having two solenoids, a conduit connection is provided to join the two solenoids together. With this arrangement only one outside conduit connection need be used, thus simplifying the electrical installation.

"Weld-Master" Arc Welder Operates on Alternating Current

Ideal Commutator Dresser Co., 1057 Park Ave., Sycamore, Ill., has developed the "Weld-Master" a.c. arc welder especially to permit simplified welding procedure on small assemblies. The design includes a reactance winding on a separate core in addition to the transformer. This reactance winding acts as a stabilizer, making it easy to strike an arc and hold it. As the distance between the end of the welding rod varies, this reactance winding causes the voltage to vary proportionately so that the arc is always smooth.

Fifteen different welding heats between 20 and 175 amp. give the operator accurate heat and penetration control for each individual job and different parts of the same job. Penetration may be over ¼ in. if desired. These heats are at two voltages—45 and 70 volts.

The standard welder is for 230 volt, 60 cycle operation. Size welding rod recommended is 1/16 to 5/32 in. Primary current is 1.75 amp. no load, 52 amp. full load. Over-all dimensions are 17x15x26 in. Weight is 190 lb. Accessories available include ground lead, electrode lead, electrode holder, welding rod, primary cord and plug.

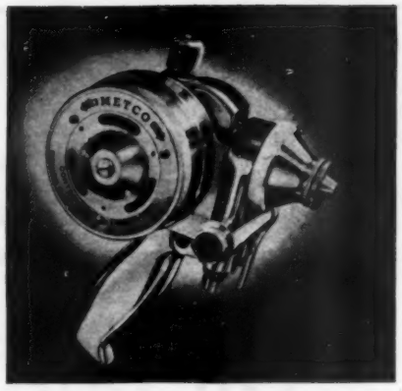


United Cinephone "Sun-Switch" Controls Level of Illumination

Levels of illumination can be controlled automatically in accordance with changes in daylight with the "Sun-Switch" photo-electric relay offered by United Cinephone Corp., Torrington, Conn. With this device, the user chooses the two lighting levels at which he wishes the load switched on and off, and adjusts the calibrated dials to the corresponding foot-candle readings. Operation is entirely automatic, no resetting being necessary.

The control is primarily designed as an aid to greater safety and economy in incandescent lighting applications. Important advantages resulting from using the device in this service include: (1) lighting that will always be on when needed, regardless of when darkness comes, (2) lighting that will never be on when the presence of sufficient daylight makes it unnecessary, and (3) no one responsible for, nor taking the time to do, the job of lighting up.

Special care has been taken in the construction of the "Sun-Switch" to make the control rugged and capable of delivering reliable performance. Housing is weatherproof drawn metal, measuring 10¾x5⅝x3½ in. Door gasket is cork, and finish of box, aluminum. Hasp permits padlocking. Operation is from 110 volts, 50 or 60 cycles.



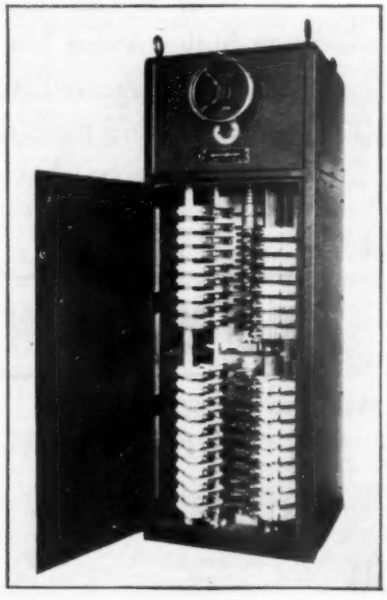
Correction—"Metco" Gun Made by Metallizing Engineering

The Type 2E "Metco" metallizing gun described previously in these columns (*AM*—Vol. 85, p 322) is manufactured by Metallizing Engineering Co., 21-07 41st Ave., Long Island City, N. Y.—not by the Metallizing Company of America, as incorrectly announced. This gun features a controlled power unit which gives uniform wire feed for production service and eliminates need for gear changes. It is also designed so that acetylene, propane, hydrogen, natural or manufactured gas can be used as fuel. Maximum air pressure required is only 65 lb. per sq. in.

Motor-Operated Motor Controller Offered by Westinghouse Electric

For use with polyphase wound-rotor motors on fan, pump, and similar drives, a new motor-operated secondary controller is announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This SC controller provides either 13 or 20 balanced points of control by varying the external resistance in the motor secondary winding.

Inclosed in a self-supporting steel



cabinet, the unit has cam-actuated contactors arranged for sequential operation in pairs from a common motor-driven camshaft. Individual cams give quick-made and quick-break contact action. Pure silver inlays on contact surfaces assure excellent current conductivity and avoid heating due to oxidation of the copper base. Separate copper arcing contacts prevent burning or pitting of main contact surfaces.

The controller drive mechanism consists of a pilot motor, a gear reduction unit, and a Geneva gear for angular movement of the camshaft. Step-by-step action is assured by a gear and pinion arrangement to move the controller one full position or point for each gear revolution. Over-travel protection is provided by auxiliary cam-actuated switches. The motor may be supplied for 115 or 230 volts d.c. and 110, 220 or 440 volts a.c. Optional features such as remote position indication, follow-up attachment and time delay operation, can be provided.

Esso "Caloria" Lubricant Withstands High Temperatures

A lubricating oil which does its work, then vanishes without a trace, has been introduced by Colonial Esso Marketers, 26 Broadway, New York, N. Y., to industries faced with problems of lubrication at extreme high temperatures. This oil, known as "Caloria," is said to be the first petroleum lubricant to embody the characteristic of complete disappearance at high temperature. It is designed to solve the old problem of lubrication under intense heat, such as is found in kiln cars, glass making machinery, ceramics and glass molds, annealing and baking ovens, working parts of die casting machines, and various hot parts of machines in the metal-working industry.

Unlike conventional petroleum lubricants which often begin to break down or crack at 400 F., and thereby leave a residue of carbon, varnish, and other matter which coats bearings and causes wear and power loss, "Caloria" is recommended only for temperatures above this where it lubricates and while doing so evaporates completely, leaving the lubricated surfaces absolutely clean. Laying up of equipment for cleaning or replacement of bearings is eliminated, replenishment of the lubricant being all that is required to maintain equipment in service.

Composition of "Caloria" is a trade secret for which a patent is being sought. The individual constituents are all petroleum derivatives and are not in themselves lubricants; only when properly combined do the mixtures possess lubricating value. The product is available in several viscosities ranging from a light-bodied water-white liquid to a viscous, slightly turbid liquid.

In addition to its ability to disappear completely under high heat, "Caloria" has another unusual characteristic. Conventional oils spread over many hundred times their original area when

(Advertisement)

Manufacturers Look to Steel Warehouses for Quick Defense Requirements

Many leading manufacturers are relying on nearby steel-service plants for prompt, stock shipment of steel to meet the current surge of business prompted by Washington's defense program.

Probably the leading exponent of "Immediate Steel" is Ryerson with a net work of ten strategically-located plants each of which has large and complete stocks of steel and allied products. In addition, each plant is equipped with complete forming and cutting facilities so steel can be prepared to customers' exact requirements. No shop should be without the Ryerson Stock List (see advertisement below).

Thousands of manufacturers report saving considerable time, trouble and money by taking advantage of Ryerson's complete flame cutting service. Modern equipment manned by specially trained operators can quickly burn any shape—no matter how intricate from carbon or alloy steel plates and billets up to 15" thick.

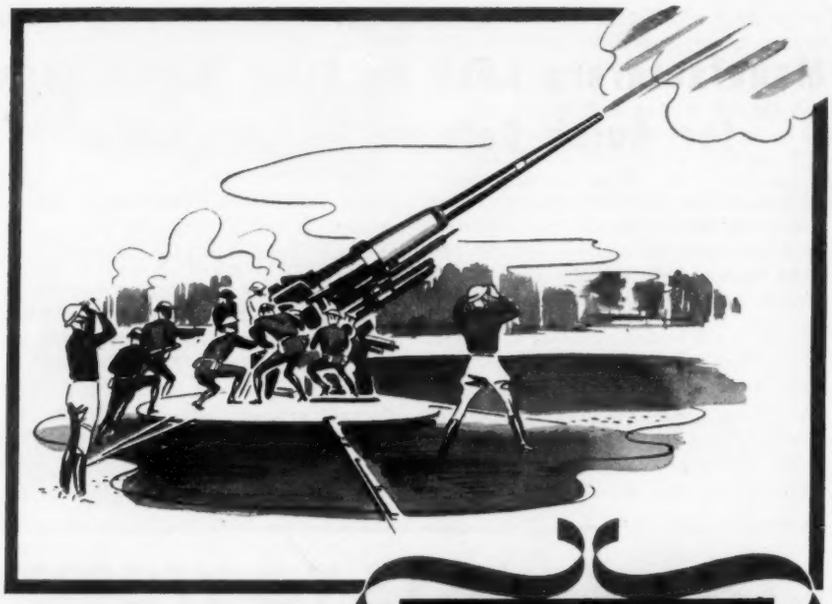
THREE WAYS TO WORK ON THIS PROBLEM OF *STEEL*

FIRST . . . Place your steel requirements clearly and fairly before your regular source. Explain exactly what you need and *when* you need it. Don't try to get a corner on steel.

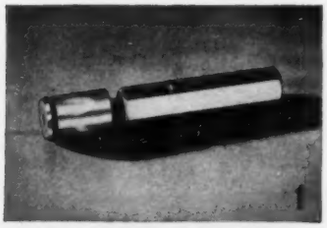
SECOND . . . Determine the physical property requirements for each job. List possible substitutions that may be used if necessary.

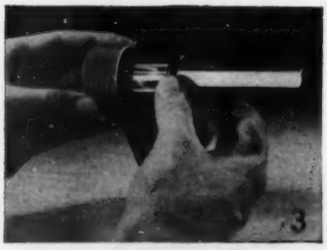
THIRD . . . Fill your immediate requirements with steel from warehouse reserve stocks. To save time send open orders, as needed sizes may be sold while the quotation is being made. You know this method is entirely safe through the Ryerson one-price policy of many years standing. Naturally, some sizes are missing but we can provide prompt shipment on most all steel products from our nearest plant.

When you have a problem of application, substitution, fabrication or procurement phone, wire or write us: We will be glad to work with you. Joseph T. Ryerson & Son, Inc. Steel-Service Plants at: Chicago, Detroit, Milwaukee, St. Louis, Cincinnati, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.



A DIRECT HIT *Every Time*





Did you ever try to put an ordinary plug gage in a hole that was just one ten thousandth inch larger in diameter? It can be done, of course, but it seldom is the first time.

Pictured below is a Sheffield Guidegage and an ordinary ring gage one "tenth" larger in diameter. One hundred men were asked to slip the ordinary rear end of the plug gage into the ring as in Fig. 2. Only two were able to do it the first time, five on the second trial and 54 required more than ten trials.

Then, each of these men were asked to insert the forward end of the Sheffield Guidegage as in Fig. 3. Every one succeeded the first time. Why? Because of the guiding disc and annular groove which forces the gage to center itself. No skill is needed whatever.

This Guidegage principle is especially advantageous in checking work that must be gaged in an awkward position or while still in the machine, and work which must be held to very close tolerances.

The principle of the Guidegage prevents undue wear and damage to the forward end of the gage, and saves a very considerable amount of time in the gaging operation.

Write for information

SHEFFIELD
GAGE CORPORATION • DAYTON, OHIO, U.S.A.
MASTER GAGEMAKERS

dropped on a surface heated to 400 F "Caloria" spreads to only four or five times its original area, assuring that it will remain in greater quantity and for a longer time on hot bearing surfaces.

For cases where lubricant cannot be re-applied before complete evaporation takes place, as in some kiln car bearings, use of "Van Caloria," which incorporates colloidal graphite, causes a thin layer of graphite to remain on the bearings after complete disappearance of the petroleum lubricant. The graphite prevents metal-to-metal contact until a new supply reaches the bearings.

NEW MATERIALS

"Hipersil" Magnetic Steel Permits Smaller Apparatus

Smaller electrical equipment requiring laminated stator construction, such as transformers, is made possible by "Hipersil" magnetic steel developed by the Transformer Div., Westinghouse Electric & Mfg. Co., Sharon, Pa. Use of this steel for transformer cores permits reducing the size of these units by about one-third, with corresponding reduction in the amount of copper required.

The material consists of a silicon steel produced by a special technique and given a heat-treatment to orient its crystals in orderly patterns which permit the material to carry one-third more magnetic flux. Not only does this new material offer a better conducting path for the magnetic flux, but it also vibrates less under the influence of the rapidly changing magnetic field.

Three Arc-Welding Electrodes Announced by General Electric

Three new shielded-arc electrodes, Types W-30, W-83, and W-93, for specific types of arc welding work have been announced by the General Electric Co., Schenectady, N. Y. All three types are heavily coated and will operate on either direct or alternating current.

Type W-30 is an A.W.S. E-6012 all-position electrode, especially designed for automotive and piece-work industries where high currents are desired for high production on lap or fillet welds. This electrode's ability to carry high currents leads to a substantial reduction in stub-end losses which ordinarily result from the use of high current.

For job welders or manufacturers engaged in the fabrication or repair of cast iron, the Type W-83 is ideally suited. It is an all-position electrode and its outstanding advantage is its ability to operate at relatively low currents, a desirable condition for cast iron.

The Type W-93 is designed for building up steel surfaces to resist wear from shock, abrasion, and rolling impact. Its extremely smooth arcing characteristics,

freedom from spatter, and wide coverage (74 sq.in. per lb.) make it well suited for such applications as agricultural implements, battered railends, snow-plow shoes, crawler-type tractor treads and wheels, and scraper blades.

Durez "775" Phenolic Plastic Suitable for General Purposes

A new general-purpose phenolic molding compound is announced by Durez Plastics & Chemicals, Inc., Walck Road, North Tonawanda, N. Y. This material, known as "Durez 775 Black," was developed to make available a plastic which would have a wider range of application than existing general-purpose ones.

Among the improvements over present compounds of this type are listed: lower water absorption, slightly higher flexural and tensile strength, and heat resistance of 400 F. It has excellent molding characteristics, fast cure, and is said to deliver a smoother, more lustrous finish than the average general-purpose material.

TRADE PUBLICATIONS

AIR CIRCUIT BREAKERS Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is circulating an 11-page bulletin, No. 33-680, which describes compressed air circuit breakers up to 34.5 kv, 1,500,000 kva. interrupting capacity, for indoor use.

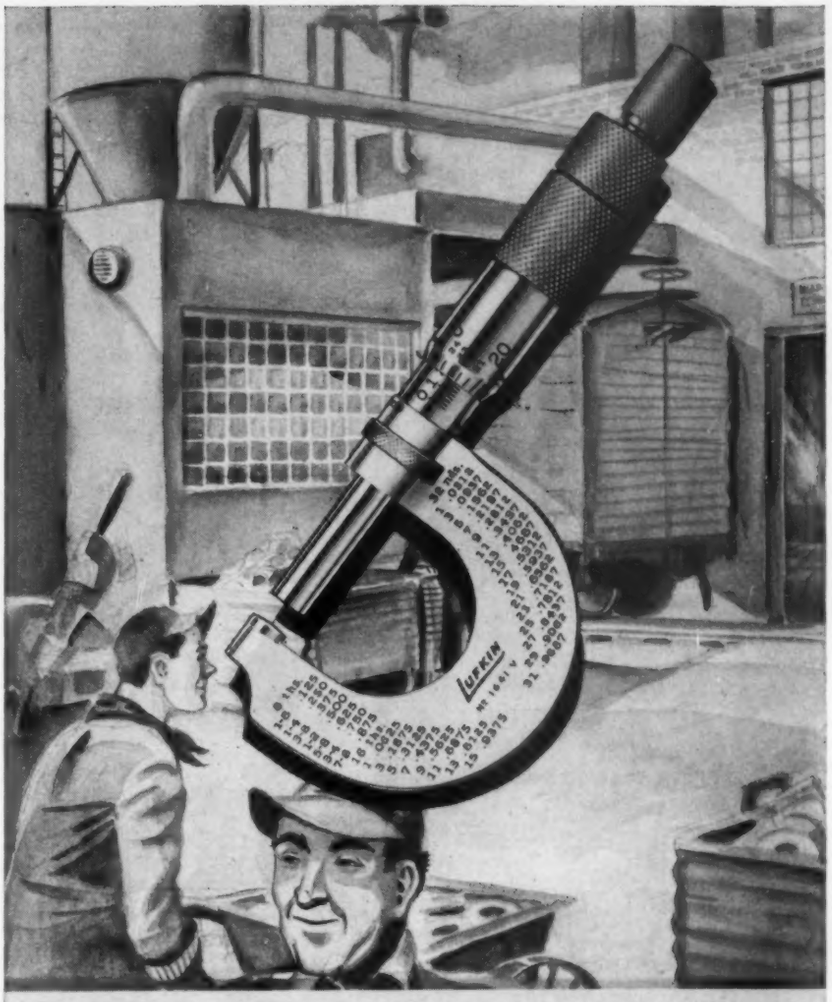
ARC WELDERS The Emerson Electric Mfg. Co., St. Louis, Mo., offers a new consumer folder, No. X4023, which features a.c. arc welders. Four models with maximum capacities of 75, 150, 200 and 300 amperes are illustrated and described.

BEARINGS Split Ballbearing Corp., Lebanon, N. H., has published a four-page leaflet which describes self-aligning pivot ball bearings. Also circulated by the concern is an eight-page booklet which describes and illustrates miniature precision ball bearings.

CONTROLS A five-page folder, "Hydraulic Automatic Control", has just been published by Reeves Pulley Co., Columbus, Ind. The leaflet illustrates and describes the various operations and includes specifications.

CORE MAKING Despatch Oven Co., Minneapolis, Minn., is circulating a 16-page Bulletin No. 31 which provides constructive information regarding core making and core baking.

EARTH MOVING EQUIPMENT La Plant-Choate Mfg. Co., Inc., Cedar Rapids, Ia., has just issued five new circulars, each 16-pages and in two colors. Circular No. A-110-636 describes each of the products manufactured by the company. No. A-111-637 describes



Where there's *Production* there's *Precision!*

America is busy. You can hear the roar of machinery inside factory walls from Maine to California. There's a fever pitch of activity, behind which Precision plays a more dominant role than ever before. Closer tolerances must be maintained—and they must be arrived at quickly. Costly errors are out! That's why Lufkin Precision Tools are today being specified by experienced manufacturers, machinists, and production men everywhere. They're designed to give the greatest degree of accuracy with the least amount of effort and at the smallest risk of human error. An examination of any of our many Precision Tools will convince you. Simply ask for our free catalog or see your dealer.

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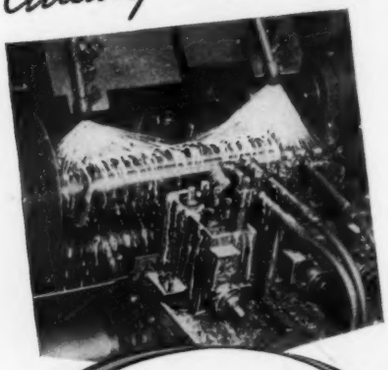
TAPES · RULES PRECISION TOOLS

Are you Licking This Cutting Problem?



Stuart's SOLVOL
LIQUID CUTTING COMPOUND

THIS LATEST Stuart Oil DEVELOPMENT IS DOING IT FOR OTHERS!

THE rapidly increasing use of carbide and other high speed tools emphasizes the immediate importance of this original type of cutting fluid.

STUART'S SOLVOL Liquid Cutting Compound *was developed especially for this exact condition.* Where operations run "too hot" for properly applied straight cutting oils — and where ordinary soluble cutting oils or soluble paste compounds fail to produce satisfactory finish or tool life — that's the place for this original Stuart Oil development in emulsifying cutting oil! *Put it on the job quick and watch the improvement.*

WIRE TODAY *for working sample — FREE to any industrial concern working on defense orders. To assure proper application please tell us name of part, stock, machine and cutting operations.*

For All Cutting Fluid Problems

D. A. STUART OIL CO.
LIMITED
Chicago, U.S.A. Est. 1865
Warehouses in All Principal Metal Working Centers

and illustrates the hydraulic trail builder; No. A-112-638 describes and illustrates the hydraulic Bulldozer and includes information on tool interchangeability, correct design and balance, and on the simple hydraulic control; No. A-113-639 describes the hydraulic "Carrimor" scrapers which range in size from 2.9 to 8.2 cu. yds., and No. A-115-641 is a circular describing the force ejection scraper.

FANS The Emerson Electric Mfg. Co., St. Louis, Mo. has just published a 24-page Catalog No. X4000, which lists nearly a hundred new fan models. Descriptions, detail construction features, performance and prices are given for all types.

FURNACES The Brown Instrument Co., Philadelphia, Pa., is circulating Bulletin No. 27-5, which describes the operation and development of an open hearth furnace pressure controller system. The booklet describes how the system works, provides illustrated models and diagrams.

INDUSTRIAL SAFEGUARDS Sellstrom Mfg. Co., 615-649 N. Aberdeen St., Chicago, Ill. is circulating Catalog No. 19 which illustrates and describes the Sellstrom line of eye and face safeguards.

OIL CIRCUIT BREAKERS A six-page leaflet, No. 33-320, circulated by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., describes the construction and operation of oil circuit breakers for starting motors. The leaflet includes drawings which show position of part and provides physical dimensions.

PORTABLE SUBSTATIONS An eight-page bulletin, No. B-2281, circulated by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., illustrates and describes portable substations which meet a wide range of operating conditions.

SCREW THREADS "Defense Emergency Screw Thread Data Book," which is Bulletin No. 60, published by the Eastern Machine Screw Corp., New Haven, Conn., illustrates and completely describes foreign and domestic screw thread systems. Fits, marking symbols and general dimensions are included in the bulletin, which sells for 15 cents.

SURFACE HARDENING The Ohio Crankshaft Co., Cleveland, Ohio, is circulating a two-page leaflet which illustrates the application and describes the Tocco process of surface hardening by electrical induction.

TURRET LATHE TOOLS Gisholt Machine Co., Madison, Wis., has just published a 168-page loose-leaf catalog which illustrates and describes a line of turret lathe tools for use on ram and saddle types of turret lathes. One hundred sixty-four tools, built in more than 500 sizes, are completely illustrated in three colors. Brief descriptions are given.

VALVES Homestead Valve Mfg. Co., Inc., Coraopolis, Pa., has issued a four-page folder which describes typical uses for valves aboard ships and in defense industries.

VOLTAGE REGULATORS Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is circulating a 15-page booklet which describes voltage regulators for generators with indirect acting exciters. The booklet discusses the application to medium and large size a.c. generators, as well as synchronous motors and condensers; operating details are also included, along with a tabulation of complete equipment for controlling a typical a.c. machine.

NEW BOOKS

THE SELECTION OF PRESSES—*By S. D. Brootzkoos. 111 Pages. Published by the Dryden Press, Inc., 103 Park Ave., New York. $2.*

Presses are ordinarily purchased either by the manufacturer's recommendation or from the user's knowledge of press parts similar to those he has in mind turning out in his new equipment. Contrasted to this approach, Mr. Brootzkoos gives the press designer's analysis of just what a given machine can do. He starts out naturally enough by a consideration of pressures required for various kinds of operations, then compares rated and actual capacities of mechanical and hydraulic presses.

For those who prefer the scientific approach to the selection of presses, this volume apparently has the answer. Most of the material contained in this volume appeared serially in *The Modern Industrial Press.*

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FIFTY HINTS FOR FEATURES OF VOCATIONAL SUBJECTS—*By M. R. Bass, director, the David Ranken School of Mechanical Trades, St. Louis, Mo. Published by American Technical Society, Drexel Ave. at 58 St., Chicago, Ill. 50 cents.*

This book is a compilation of suggestions for presenting to the vocational student the subject matter of the course in such a way that he will grasp it most readily. In themselves, the suggestions form a concise teaching technique, based primarily on the psychology of education. The teaching hints cover the instructor's responsibility to the student, cooperation between the instructor and student, development of student's initiative by the proper teaching technique and instituting on the student's part responsibility toward his course of study, his fellow students and the material and equipment.